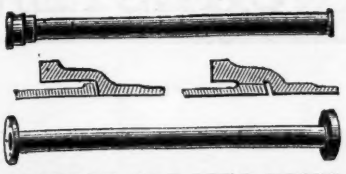
# THE JOURNAL OF GAS LIGHTING
## WATER SUPPLY & SANITARY IMPROVEMENT

VOL. LXVIII. No. 1746.] LONDON, OCTOBER 27, 1896. [48TH YEAR. PRICE 6d.



GAS AND WATER PIPES
1½ to 12 IN. BORE.



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Bonlea Foundry,
SOUTH STOCKTON-ON-TEES.
Formerly Springbank Iron-Works, Glasgow.
ESTABLISHED 1848.
ALSO MANUFACTURERS OF
SANITARY & RAIN-WATER PIPES, HOT WATER PIPES, STABLE FITTINGS, RANGES, STOVES, And GENERAL CASTINGS.
Telegrams: "BONLEA, STOCKTON-ON-TEES."

Lanemark Coal Co.,
LIMITED.
LANEMARK CANNEL
AND GAS COALS.
*Quotations and Analysis on Application to*
LANEMARK COLLIERY,
NEW CUMNOCK, N.B.
Shipping Ports: All the principal Scotch Ports.

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Manufacturers & Contractors.
THE ONLY MAKERS OF
PATENT ANTIMONY PAINT,
Parker's Imperial Black Varnish,
*Oxide Paints, Oils, and General Stores for Gas and Water Works.*
WORKS:
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CANNEL COAL MERCHANT,
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*Prices and Analysis of all the Scotch Cannels on Application.*

HOUSE'S VOLCANIC JOINTING FIRE FOR RETORTS.
for STEAM, GAS, and WATER.
OVER 2000 USERS.
CEMENTS
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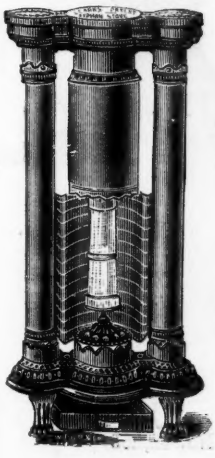
JOHN BROWN & CO., LTD., SHEFFIELD.
Proprietors of
ALDWARKE MAIN, CAR HOUSE & ROTHERHAM MAIN COLLIERIES, NEAR ROTHERHAM.
ALDWARKE MAIN GAS COAL
Analysis: 12,600 Feet of 19-Candle Gas per Ton.
Value in Pounds of Sperm, 820·80.
VERY FREE FROM IMPURITIES.
TELEGRAMS: "ATLAS, SHEFFIELD."



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"SYPHON" STOVES
FOR USE WITHOUT A FLUE.
NO FLUE REQUIRED. NO SMOKE. NO SMELL.
NO DIRT OR TROUBLE. NO DANGER.
The "SYPHON" Stove produces A PURE, EQUABLE, AND AGREEABLE HEAT, which can be graduated or sustained at the will of the user.
The most economical and convenient Heating Apparatus for all classes of Dwellings, and eminently suited for ENTRANCE HALLS, BEDROOMS, CONSERVATORIES, SHOPS, OFFICES, GALLERIES, CONCERT ROOMS, VESTRIES, &c., &c.
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THE "POSITIVE" PREPAYMENT SLOT METER.

Noted for Strength and Simplicity of Construction.

Used by many Corporations and Gas Companies.

Material and Workmanship of the best.

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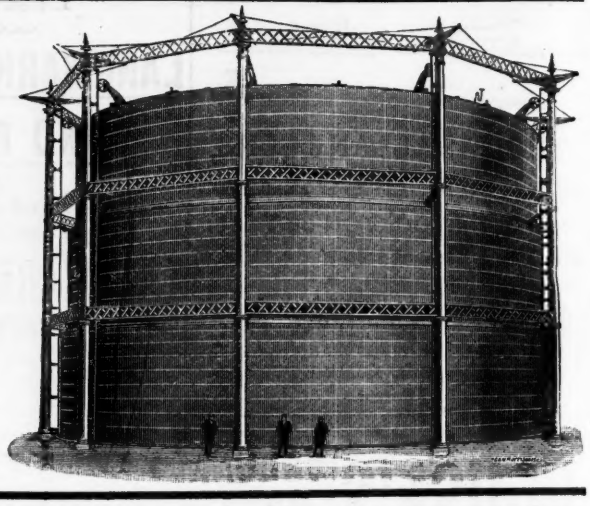
**OF EVERY DESCRIPTION.**



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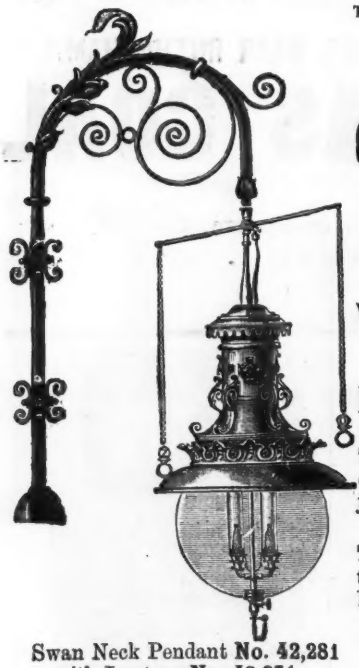

Swan Neck Pendant **No. 42,281** with Lantern **No. 42,271.**

## THE "VERITAS" GAS ARC LANTERNS

**(PROTECTED BY ROYAL LETTERS PATENT)**

SPECIALLY CONSTRUCTED FOR THE

**Incandescent System of Gas Lighting.**

**Wind, Rain, and Dust Proof.**

**Enamelled Steel throughout.**

**Made for One, Two, Three, and Five Lights.**

The undisputed great advantages of the **Incandescent System of Gas Lighting** are frequently prejudiced by atmospheric influences upon the Mantles or by sudden gusts of wind.

These deficiencies have been entirely overcome by the construction of our "VERITAS" GAS ARC LANTERN, which differs from others, and which we are confident is the best yet offered.

Each Lantern complete; nothing to get out of order; and no skill is required in fixing.

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**(Wholesale only.)**

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GAS APPARATUS OF EVERY DESCRIPTION.

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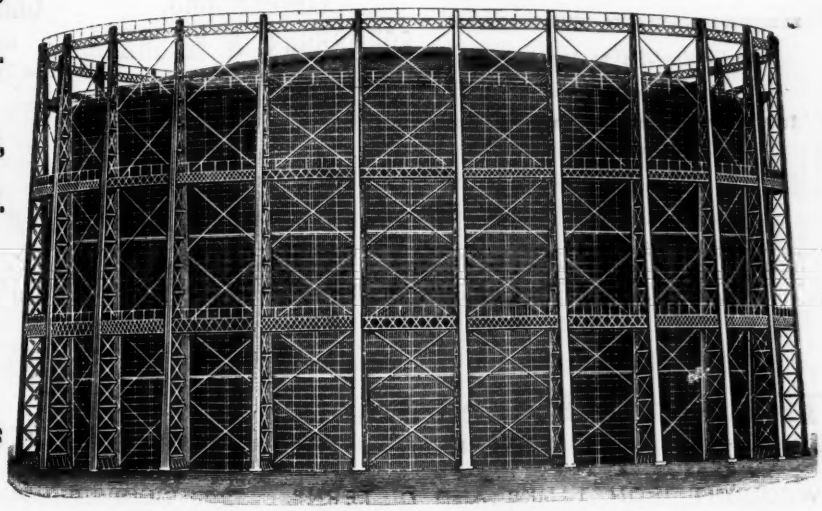

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PIPES, VALVES, AND CONNECTIONS.

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240 feet Diameter by 45 feet Deep each Lift. Erected at Glasgow, 1893.

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# GAS EXHAUSTING MACHINERY

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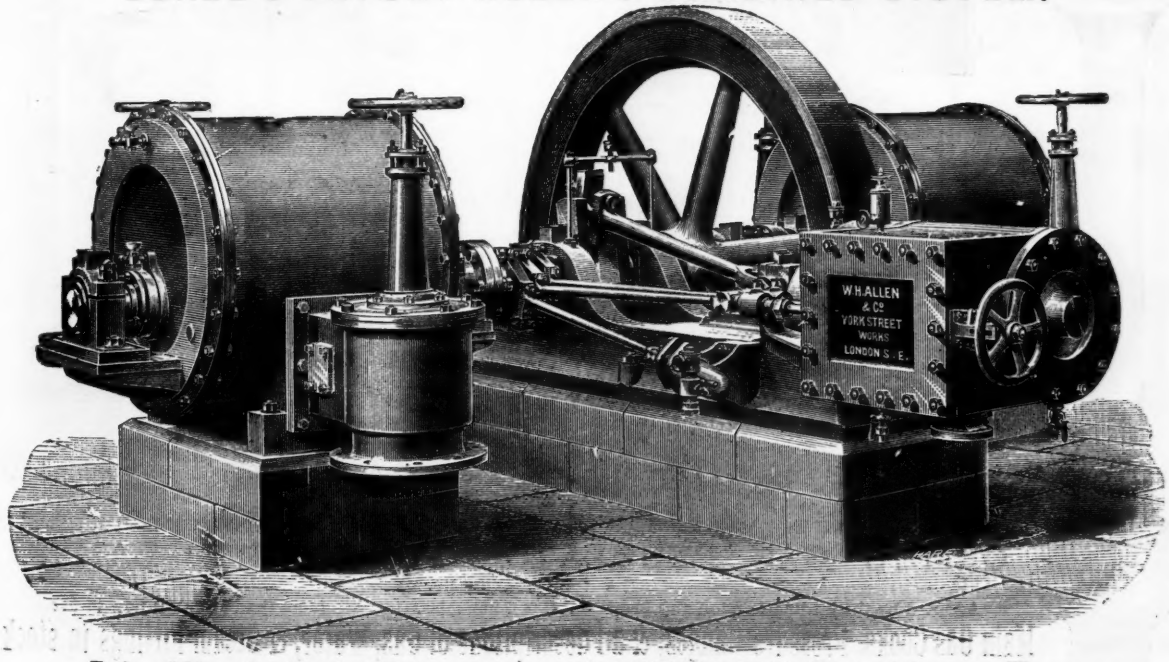


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REAL OLD SILKSTONE GAS COAL,
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GASHOLDERS,
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CAST-IRON RETORTS,
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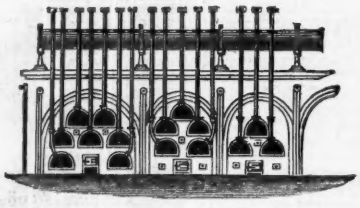

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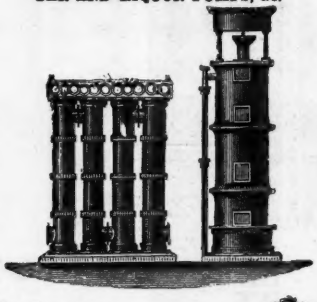

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for working Purifiers,
Also Bye-Pass & Stop Valves.

PURIFIERS with Planed Joints,
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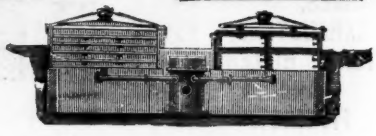

DESIGNS, SPECIFICATIONS, AND ESTIMATES FREE.

Pig Iron (*Special Quality*) for ENGINE CYLINDERS, &c.

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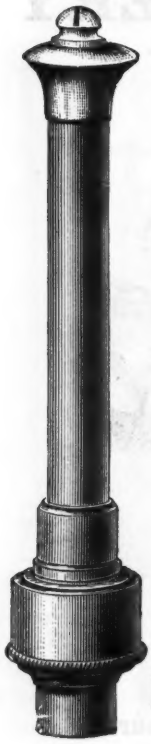
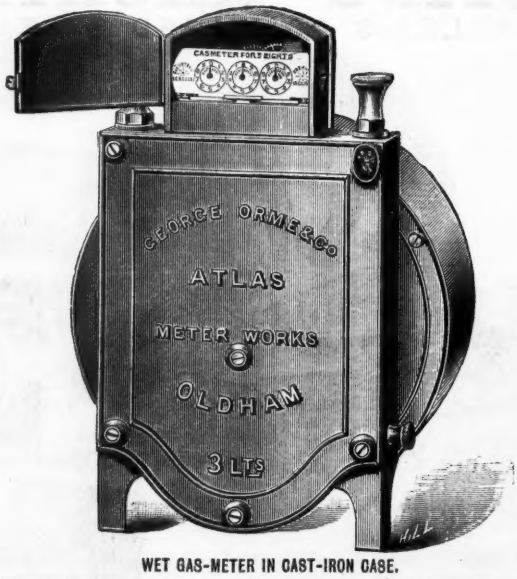
Telegraphic Address: "ORME OLDHAM." National Telephone No. 93, OLDHAM.



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ORME'S GAS REGULATOR FOR STREET LAMPS.
AS ILLUSTRATION NO. 200.
Adopted by the leading London and Provincial Gas Companies. More than 150,000 now in use.
Main Gas Cocks, Pressure-Gauges, & all descriptions of Gas, Water, & Steam Fittings in stock.

No. 200.

Illustrated Price Lists and full Particulars on application.

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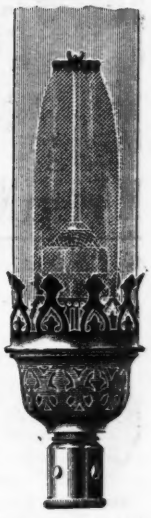
(WELSBACH Patents.)

Pronounced by Mr. Justice Wills, and confirmed by the Court of Appeal, to be

# "A PIONEER INVENTION."

FURTHER DEVELOPMENTS; ENORMOUS ECONOMY;
IMMENSE SUPERIORITY; IMPORTANT IMPROVEMENTS.



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## THE NEW "GEM," 5s. 6d.
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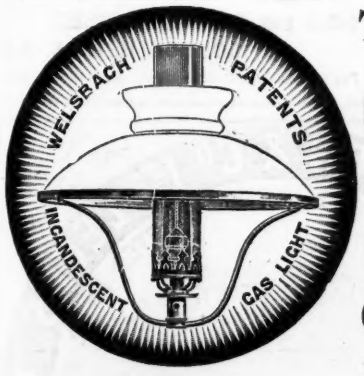
35-Candle Power from $1\frac{3}{4}$ Cubic Feet of Gas!!!

THE "GEM" BURNER IS SPECIALLY SUITABLE FOR DOMESTIC LIGHTING.
GREATLY IMPROVED DISTRIBUTION OF LIGHT.

It is the Brightest "Gem."
20 Candles per Cubic Foot of Gas!!!




The WELSBACH INCANDESCENT GAS-LIGHT is the

MOST ECONOMICAL
MOST BRILLIANT
MOST HEALTHY
CLEANEST GAS

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## THE "GEM" BURNER, 5s. 6d.
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# WINTER 1896-7. BEFORE THE FROSTS COMMENCE WINTER 1896-7.

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WHICH HAS BEEN FITTED TO MANY OF THE LARGEST GASHOLDERS IN LONDON AND THE PROVINCES, AND IN AUSTRIA, GERMANY, DENMARK, AND THE UNITED STATES.

**Full Particulars and Prices from S. CUTLER & SONS, MILLWALL, LONDON.**

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Incorporated with the Leeds Fire-Clay Company, Ltd.,

WORTLEY FIRE-CLAY WORKS, Near LEEDS,

Have confidence in drawing the special attention of GAS ENGINEERS to the following advantages of their Retorts:—

1. Smooth Interior, preventing adhesion of Carbon.
2. They can be made in one piece up to 10 feet long.
3. Uniformity in thickness, ensuring equal Expansion and Contraction.

PATENT

## MACHINE-MADE GAS-RETORTS.

Gas-Bags for Mains. High Water-Boots. Woollen Miners' Jackets.

Delivery and Suction Hose, Gutta-Percha Acid Bottles, Leather Driving Bands, Woven Canvas Hose for Fire-Engines, Wedge and Square Gas-Bags, Air and Water Beds for Invalids, Oil Tarpauling Coats, Trousers, Hats, &c., Squeegees for cleansing Pavements, &c., Billiard and Bagatelle Cush, Tricycle Tyres, Leather Hose, Cotton Waste, Engine Cloths, Oils, &c., India-rubber Waterproof Garments for Walking, Driving, or Sporting Wear, Diving and Wading Dresses, Printers' Blankets, Iron Wheels and Rollers covered with India-rubber. Stokers' Gloves, 14s. 6d. per dozen.

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## JOSEPH CLIFF & SONS,

INCORPORATED IN THE LEEDS FIRE-CLAY COMPANY, Ltd.,

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MACHINE-MADE RETORTS

Have been made in large quantities for the last twelve years; and during the whole of that time, have been in regular use at most of the largest Gas-Works in the Kingdom. They possess the excellent quality of remaining as near stationary as possible under the varying conditions of their work—a quality which will be appreciated by all Gas Engineers and Managers. The generally expressed opinion is that these Retorts are the very best that are made.

RETORTS CAREFULLY PACKED FOR EXPORT.

Fire-Bricks, Lumps, Tiles, &c., &c., of every description suitable for Gas-Works.

## HARPER & MOORES, STOURBRIDGE.

MANUFACTURERS OF

**BEST FIRE-BRICKS, GAS-RETORTS,**

LUMPS, TILES, AND ALL ARTICLES IN FIRE-CLAY.

Proprietors of Best Glasshouse Pot, Crucible, and other Stourbridge Clays.

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ESTABLISHED 1836.

## The Climax of Regenerative Gas Lighting!!

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## "VERTMARCHE"

A 280-CANDLE POWER PLAIN IRON LAMP,

CLASS A— **55/-**

LIGHT for LIGHT less than half the price of any other Regenerative Lamp.

Manufactured in England.

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PARTICULARS AND PRICES FREE. AGENTS WANTED.

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CLAYTON, SON & Co LTD LEEDS
ALL KINDS GAS PLANT
12,100,000 CUB FT CAPACITY.
COMPLETED IN 12 MONTHS
GASHOLDERS OUR SPECIALITY
MAKERS OF THE LARGEST GASHOLDER IN THE WORLD
IT IS 300 FT DIAM. HAS SIX LIFTS, EACH 30 FT DEEP. HAS NO ROPES OR SPIRAL GUIDES.
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# WEST'S GAS IMPROVEMENT COMPANY, LTD.,

## ALBION IRON-WORKS, MILES PLATTING, MANCHESTER.

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FOR

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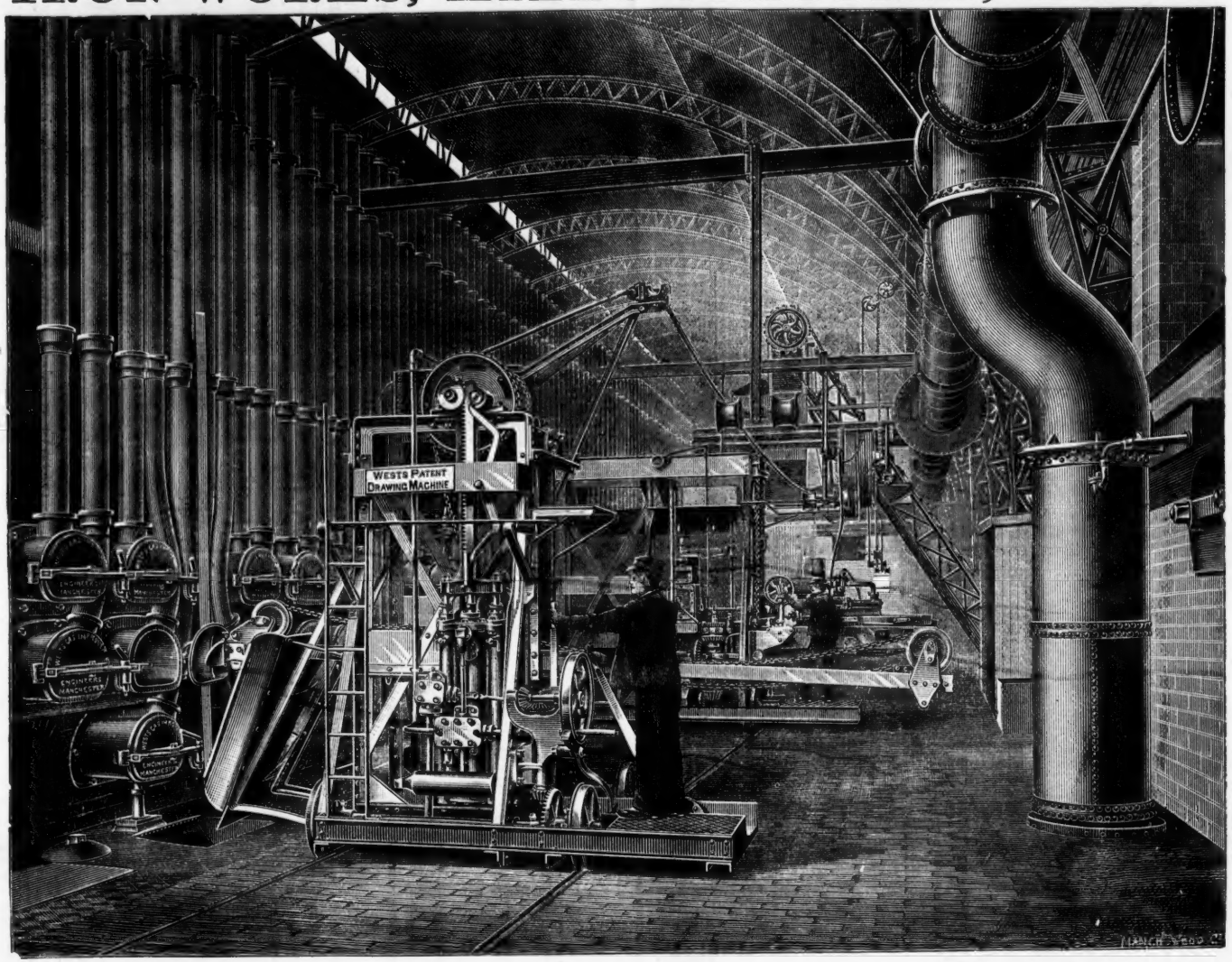
GAS-

RETORTS.




Interior of Retort-House at the Bradford Road Gas-Works, Manchester, showing the Compressed-Air Drawing and Charging Machines.

AND

104, Queen Victoria St.,

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OVER

560,000

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FEET

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RETORTS

DAILY

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WEST'S

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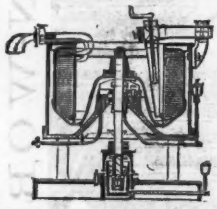
MARSHALL'S PATENT COMBINED BATTERY CONDENSER AND SCRUBBER.

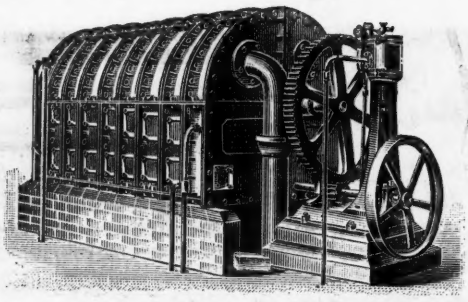
Extract from letter from Mr. Winstanley, of Coventry: 'The Condensers you erected for us have been in use some time, and are working very satisfactorily.'

BURMEISTER AND WAIN'S TAR-SEPARATOR.



EXTRACTS OVER 99 PER CENT. OF AMMONIACAL LIQUOR FROM TAR.

## PATENT "STANDARD" WASHER-SCRUBBER.

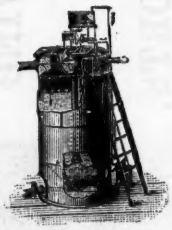


OVER 530 MACHINES

*In use and in course of Construction.*

They extract all the Ammonia and a large proportion of Carbonic Acid and Sulphuretted Hydrogen.

BRUUN'S PATENT WATER SOFTENER



PREVENTS ALL "SCALE" AND SAVES FUEL.

MARSHALL'S PATENT TAR EXTRACTOR AND WASHER.

Extract from letter from the Late Mr. Jabez Church: "The Marshall Patent Tar-Extractor has given very satisfactory results."

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**Are exclusive Owners of the well-known HAIGH HALL & KIRKLESS HALL GAS COAL COLLIERIES and supply the Best Wigan Arley Mine Gas Coal, Gas Nuts, Gas Cannel, Cannel Nuts, &c.**

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TELEGRAPHIC ADDRESS: "WIGAN BIRMINGHAM." TELEPHONE No. 200.

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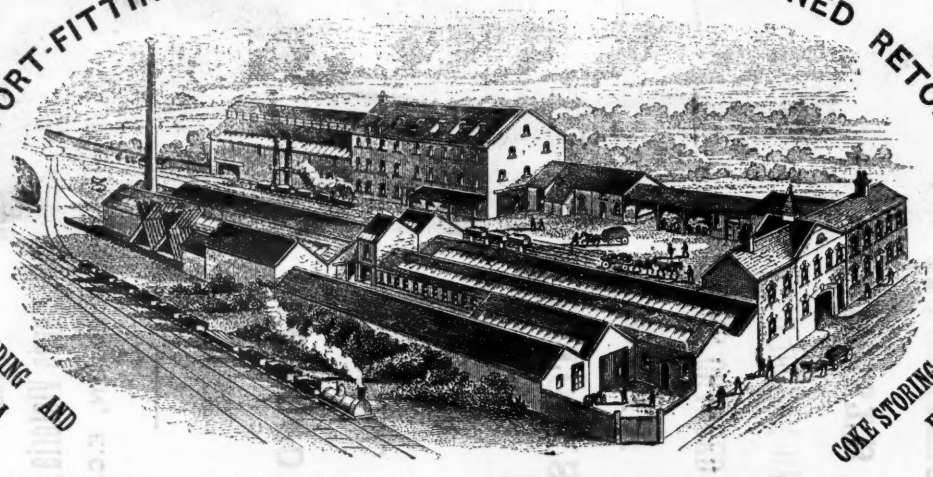
COAL-BREAKERS. COKE-SCREENS.

MOUTHPIECES. LIQUOR-TANKS.

RETORT-FITTINGS, REGENERATOR SETTINGS, INCLINED RETORTS.



COAL UNLOADING AND CONVEYING A SPECIALITY.

COKE STORING PLANT, ENGINES, EXHAUSTERS, VALVES.

BEEHIVE WORKS, **RETFORD,** NOTTS.

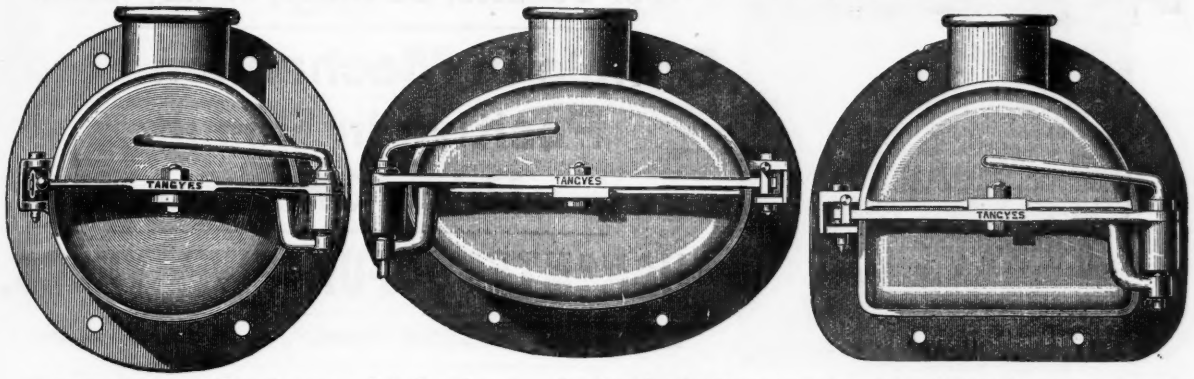
# TANGYES LIMITED, CORNWALL WORKS BIRMINGHAM;

AND AT

LONDON, NEWCASTLE, MANCHESTER, GLASGOW, SYDNEY, JOHANNESBURG, BILBAO, AND ROTTERDAM.

## MORTON'S SELF-SEALING RETORT-LID,

**With Holman's Anti-Friction Catch, Self-Sustaining Cross-Bar, and Improved Eccentric Bolt.**




These Retort Lids and Fastenings are made in three forms, round, oval, and ⌂ (as shown above), in each of which we have a very extensive variety of patterns, from which Gas Engineers contemplating the adoption of these Lids are recommended to make their selection, in order to avoid cost of pattern-making, delays, &c., &c.

QUOTATIONS WILL BE GIVEN ON RECEIPT OF PARTICULARS OF REQUIREMENTS.

LIST OF PATTERNS ON APPLICATION.

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## STOKERS' GLOVES.

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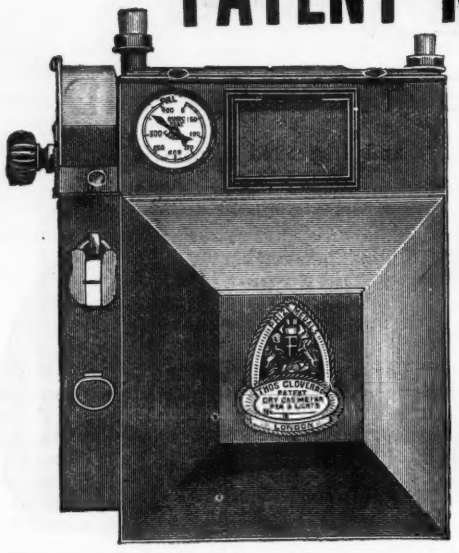

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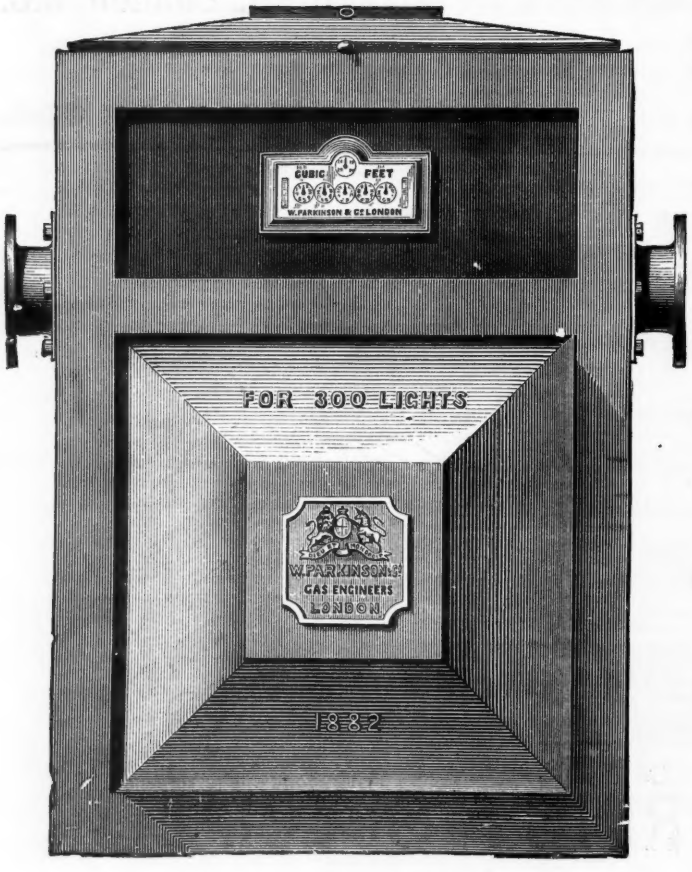


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## EDITORIAL NOTES.

### The Liverpool Gas Directors and the Corporation.

In another column will be found the text of the "Observations" by the Directors of the Liverpool United Gas Company on the report of the Lighting Committee of the City Council, which was made public last June. We have given the particulars of this report, and also reproduced as much as is important of the discussion upon it at the Council meeting on July 1 last. Upon that occasion, the report as adopted by the Lighting Committee was approved by a large majority; and it was referred to the Committee "to take such steps as they might think advisable to carry "out the recommendations contained in the report." The first step taken was to submit a copy of the report to the Directors of the Gas Company, in order to obtain their views; and it is the result of this by no means hurried consideration of the report by Mr. Edward Lawrence and his colleagues that we now publish, together with the comments of the Sub-Committee appointed to deal with it in the first instance. The next stage of the proceedings will be the public debate in the City Council and the resolution consequent upon it, which we may be able to record next week. We do not expect anything of importance to come out of this business. Sir Arthur Forwood, after bringing up the report of the Lighting Committee, resigned the chairmanship of this body, which he would hardly have done if the report had been of a character to necessitate further action by the Corporation. Indeed, it was made the ground of the only complaint heard at the Council meeting in July last that the report praised the Company instead of finding fault with everything in and about the undertaking—as if Liverpool ought to be aggrieved at being informed that the ignorant clamour raised against the Company was baseless! Though the Committee's report left Sir A. Forwood nothing to do on behalf of the city, it contained several suggestions of reforms which he declared he should be glad to see carried out by the Company. We confess to entertaining regret that the Directors should have thought fit to return, as they have now done in their "Observations," a simple *non possumus* to all the suggestions they discuss.

The Directors are fully justified in claiming that the Lighting Committee's report is, as they say, "a complete "vindication from the charges that have been publicly "brought against them;" and they could not be expected to admit that the expert advice upon which the Committee acted in framing the part of their report which deals with the technicalities of gas manufacture was of superior quality to that which is, and has for many years been, at their own disposal. Upon the main recommendations of the Committee, however—administrative and financial—the "Observations" are disappointingly colourless and weak. It would have been much more to the credit of the Directors for wisdom if, instead of entering into the merits of any of the suggestions laid before them, they had merely returned, duly embedded in polite verbiage, the observation that since none of the matters in question could be touched by anything short of an Act of Parliament, which the Company had no intention of promoting for any purpose of their own, discussion of such subjects at this time is of no practical use. Such a reply would have left matters precisely where they were before the inquiry, and where they are now; while it would have saved the Directors from the supposed necessity of taking the small point they urge against the proposal for Nominee Directors. There is no apparent reason why they should have offered such an argument against this suggestion, while avoiding discussion of the important question of the illuminating power of the gas supplied in Liverpool, which is quite as prominent a point of the Lighting Committee's report. We are sorry that we cannot compliment the Liverpool Gas Directors upon their answer to the Corporation Committee. It is all perfectly true, of course; but the disappointment expressed by the Sub-Committee is likely to be general.

### Municipalism in Paris and London.

It is easy to understand why the fancy of the modern municipal Progressive lightly turns to the fair city of Paris when he wants to preach the lesson of what Municipalism can accomplish under certain conditions. Here he finds the greatest triumphs of city "improvement" the world can show, presided over by any amount of government,

in the constitution of which democracy and autocracy are very charmingly blended. There is not in Paris much of that troublesome "liberty of the subject" with which the true Progressive has such scant sympathy. The Parisian is supposed to experience so much satisfaction from being permitted to cry "Vive la République!" instead of being required to shout "Vive l'Empereur!" and also from the knowledge that the Municipality is democratic to the verge of reproducing the Commune, that he is expected to do what he is told and pay his taxes thankfully. The Municipality of Paris, in short, has that "free hand" in carrying out its policy, and in making the people pay for the same, which is as yet denied to such bodies as the London County Council. So it is not to be wondered at that the advanced British Progressive goes over to Paris whenever he can—not to enjoy himself, but to bring home some pictures of what is being done by a Municipality after his own heart. The current issue of our contemporary "London" contains a glowing account of municipal work in Paris, in which the beauty of the markets, the gorgeousness of the Hôtel de Ville, and other attractive matters, are described and illustrated by way of guidance to the workings of that "healthier and nobler municipal spirit "which has been awakened" in London—presumably, by the County Council. Unhappily for the awakeners in question, the process appears to have gone either too far or not far enough, seeing that the provision of a London copy of the Paris Hôtel de Ville is one of those things denied to the Council—either because the public are not awake to the necessity of it, or else see too well what the bill would amount to. The Paris Municipality undertakes many things; and those undertakings which it does not control are made to help to pay for those that are already municipalized. This, again, is a cause of envy on the part of the London Progressive, who does not see his way to getting a farthing out of the profits of the London Gas Supply. How different it is in Paris! The writer in our contemporary recounts accurately all the particulars and the gross amount of the tribute paid by the Paris Gas Company to the Municipality, and concludes this part of his story with the statement that the Municipality "in a "few years' time will take over the rights of the Company "—an immensely valuable asset." But this is not quite correct, inasmuch as it is merely the distributing plant of the Company—largely composed of thin sheet-iron mains not made to last long—that will have to be surrendered on the expiration of the existing gas concession; and for all these things the Company make ample provision out of revenue. The circumstance that the Parisian gas consumer pays two shillings or half-a-crown for what in London would be a shillingsworth of gas—and better gas at that—is, of course, ignored by this reporter. This is the failing of these perfervid admirers of rampant Municipalism—they very rarely give a thought to the cost of it all. The writer in "London" is compelled, however, to confess that Paris is more than four times as heavily indebted as London, head for head; and that it is only the *octroi* which keeps the Municipality going. Being an indirect tax, the population are not supposed to feel the burden of this duty on every article of consumption; whereas in London, where everything has to be put upon the rates, the public will not stand municipal enterprise after the Paris model. This is true enough; and if people in England could only see the whole of the picture of what French taxation means to those upon whom all its weight comes in the last place—the poor—they would better appreciate the English system, and make it a cardinal point of municipal politics that there should be no indirect taxation of any kind in their midst.

#### A Scottish Plea for the Reform of Private Bill Procedure.

Lord Balfour, Secretary of State for Scotland, and the Lord Advocate received in Edinburgh last week a deputation from the public authorities of Scotland and other bodies interested in the reform of procedure in Private Bill Legislation. The grievance expressed by the deputation was the old one of the inconvenience and costliness of the existing system of requiring all Scottish Private Bill business to be taken to Westminster; and it was represented that the national dignity, as well as the equally natural regard for economy, would be better subserved by an alteration of the parliamentary arrangement whereby this class of business could be transacted in Edinburgh. There is no modern statesman better qualified to deal with a question of this kind than Lord Balfour, who has in his time done a great deal of laborious public service in the Westminster Committee-rooms. In his reply to the deputation, he assured them that he fully recognized and understood the feeling that prompted the request that the matter should be taken up by the Government as a point of practical legislation; but he laid stress also upon the fact that the general question of the reform of Private Bill Legislation has engaged the attention of Parliament for forty years, without anybody being able to suggest a substitute for the present system that would stand the test of criticism. He referred to the great danger of having too fixed a tribunal for the settlement of new legislation; and he declared it to be his belief that a paid and permanent Private Bill Commission, if it had been in existence during the past thirty or forty years, would not have moved so much in accordance with popular sentiment and desires, while keeping in the main to certain principles, as the shifting Commissioners of the two Houses have done. He also pointed out that the existing system is sometimes unduly charged with expenses which must be incurred whatever system is adopted. At the same time, he acknowledged the extreme desirability of extending the practice of holding local inquiries, if a suitable scheme could be propounded with this object, in which the general control by Parliament should be conserved. All this is, of course, very statesmanlike and sensible, and just what might have been expected; though it is hardly to be supposed that such a douche of official cold water was enjoyed by the reformers who want to create a little Westminster in the Scottish capital. There is probably a certain amount of sentimental feeling in regard to this matter among those who would take part in a deputation to the Secretary for Scotland to ask for a small instalment of Home Rule; but sentiment is altogether out of place in a question of Private Bill procedure. Scottish promoters and opponents of private legislation do not suffer more on account of having to go to Westminster than people coming for a similar purpose from any other part of the kingdom. A matter of a few miles journeying by rail more or less is not very material in connection with this class of business. It is of far greater importance to resort to the best place for getting the business done; and this is, unquestionably, Westminster. If Scotch Private Bill business did not come to Westminster, Westminster would be required to go to Scotland to deal with it; and the question of which course is to be preferred is purely one of comparison of advantages and drawbacks. The Dunfermline arbitration case, now in progress, is a good example of the impossibility of drawing the line of nationality between Scotland and England when important business, of the nature of that with which Parliament so often has to deal, has to be done.

#### A View of American Industry.

In the "Daily Telegraph" for last Friday, there appeared an interesting article on American topics, which has supplied us with material for comment in another column. Besides his references to the uses of electricity in the United States, the writer discourses with much acuteness and insight upon the industrial problems and phenomena that confront the English traveller in this land of "trusts," "combines," and other fearful wild-fowl. He remarks upon the enormous scale on which most of the great industries of the country have been planned. "No-"where does it stand out more strikingly than in this "State of Pennsylvania—the land of oil, coal, and iron, and "the home of Protection. The despotic sovereigns of trade "here have not aimed at supplying their own immediate "neighbours, but a continent. The iron kings have "hedged round the whole United States to make it their "sole market, at their own prices; while the monarchs "of oil have subjected the entire world to their sway." With the natural advantages they possess, the observer wonders how the monopolist manufacturers manage to persuade the public that they stand in need of Protection. Consumers of oil all the world over, at any rate, know that some of them are well able to protect themselves. He writes concerning the circumstances of the Pittsburg industries, that the supply of natural gas is giving out; and he also has the impression that the oil is not so abundant as it used to be, and that old wells are being abandoned more rapidly than new ones are opened up. But

the supply will last for a long time yet. Pittsburg is a smokier place than ever. "American furnaces, ovens, "and engines seem to be specially designed to produce "the maximum amount of the blackest smoke. There are "laws against it, and they are executed with all the rigour "of American State decrees, when the rich and the "mighty are the offenders—that is to say, not at all. "With coal at a dollar a ton, you can afford to blot "out the heavens and blacken the landscape; and "yet it is these very Pittsburg manufacturers that cry "so loud for Protection." The protective duties are put on, it appears, in order to keep English trade out of the Pacific coast. In other words, the entire West pays tribute to Pennsylvania and Ohio. This is not admitted; the plea put before the public being that English labour is not so well paid—generally speaking, a plea false in fact—and they must have Protection in America for the sake of the working man. Hence the great steel-works of Pennsylvania are supported largely by involuntary contributions, which are levied by the aid of the Government, and are pocketed by the manufacturers. The share that comes to the workman is microscopic. This is an old story; but it is one that Americans will not learn, even though it is notorious that the sinews of war for "Candidate "M'Kinley," who wants to protect native industries still more when he becomes President of the United States, are mainly supplied by the suffering millionaires of Pittsburg and Chicago. It is certainly something to be thankful for that the gas industry of Europe is not yet a branch of the Standard Oil Company.

### Proposed General Index of Technical Publications.

THE Federated Institution of Mining Engineers are taking the initiative in a movement of immense practical importance to technical workers. We have received from the Secretary, Mr. Walton Brown, a circular drawing attention to the regrettable decision of the recent International Conference, held under the auspices of the Royal Society of London, that the International Catalogue of Scientific Literature, which is to begin with 1900, is to relate to pure science only—applied science being rigidly excluded. The circular goes on to observe that it would seem desirable to have a Conference of Technical Societies to discuss the publication of a "Subject-Matter Index to "Technical and Scientific Periodicals." The Institution of Mining Engineers have been considering for some time the question of the publication of such an index of subjects of interest to mining and metallurgical engineers; and it is suggested that probably a comprehensive index to engineering and other technical papers would prove more valuable. This contemplated conference might, it is suggested, also consider other questions of interest to technical societies, which lack of concerted action has hitherto rendered difficult of solution. One such question is the excessive cost of postage of Transactions, as to which it is observed that there is no valid reason why they should not be placed in the same position as publications registered as newspapers. The idea of a conference of technical societies is a good one; and we gladly mention Mr. Brown's circular here in order that those of our readers who may agree with him in this regard may be prepared to render such help as may be in their power towards the attainment of his praiseworthy object. The encouragement of research is sometimes talked about in connection with the proceedings of the societies that represent the gas industry; and the furtherance of the publication of a comprehensive index of papers and other occasional contributions to the literature of applied science would, in our opinion, be one of the best possible realizations of this very praiseworthy desire to extend the boundaries of knowledge.

**Midland Association of Gas Managers.**—The autumn general meeting of this Association is to be held next Thursday, at the Grand Hotel, Birmingham, under the presidency of Mr. W. R. Cooper, of Banbury. We learn, from the programme issued by the Honorary Secretary (Mr. C. Meiklejohn, of Rugby), that the business will consist of the election of new members and officers and the reading of three papers. Mr. H. P. Maybury, of Great Malvern, who joined the Association early in the year, will submit for the consideration of his colleagues some "Notes on a Pneumatic Painter;" Mr. T. Ebenezer Pye will describe "The Incandescent Fire-Mantel;" and Mr. Thomas Glover, of West Bromwich, will deal with the subject of "Commercial Coal Testing."

## WATER AND SANITARY AFFAIRS.

THREE months ago, the London County Council resolved that "a Bill or Bills should be prepared for introduction "into Parliament in the session of 1897 for the purchase "of the undertakings of the eight Metropolitan Water "Companies." There was a peculiarly indefinite preamble to this proposition, due to the ingenuity displayed by Lord Onslow, who sought to effect a species of compromise between the Progressives and the Moderates concerning the question of the water supply. Some of the Moderates rebelled against their leader, and declared that they were not in favour of purchase at all, but of control. There was consequently a "split" among the Moderates, much to the delight of the Progressives, who gained adherents to the policy of purchase. But Lord Onslow's preamble, which formed part of the final resolution, declared that the Council decided on dealing with the question "without in any way committing itself at "this stage to the terms of purchase and forms and "other provisions of the Bill or Bills." The question has now reached another stage, when something less nebulous and better defined is naturally looked for. The Water Committee, who brought the subject forward, signified that "the precise form of the proposals" would come before the Council when the Bills were prepared. The Council, we understand, intend to carry out their resolution; and we are curious to see how they propose to do it. But less than a month after they had decided to bring the matter into Parliament, there appeared a letter from the First Lord of the Treasury, stating, in reference to the Metropolitan Water Supply, that the Government were "deeply sensible" of the importance of the question; added to which was the striking declaration: "We strongly feel that the next session ought not "to pass without a solution of the question being arrived "at." Will the Council accept this as a reason why they should let their Purchase Bills "slide," in the same way that they allowed their Usk and Llangorse scheme to be shut off by a Standing Order? There are Standing Orders, not their own, over which the Purchase Bills can opportunely come to grief. Why should the Council be so extremely anxious that the coming authority, if there is one to come, should be in a position to purchase the undertakings of the Water Companies "with as little "delay as possible"? Why should Lord Onslow busy himself in the matter—all the while arguing against the spirit of his own resolution, and at the same time standing up in opposition to Sir John Lubbock? Amid this imbroglio we are almost prepared for anything; and we should not be surprised if in this matter, as in the case of the preliminary part of the Welsh scheme, we should find the Council "riding for a fall." Or will they communicate with the Local Government Board, and politely stand aside for the Government to proceed? Finally, will the Government do anything, so far as the coming session is concerned? Mr. Balfour's letter is not an absolute pledge. The Government are "deeply sen-"sible," and "strongly feel." But, after all, they may find it impossible to effect the solution in the coming session, even though they make some show of attempting it. As for the Council, there may be considerable difficulty in getting the Moderates to agree with the Progressives respecting the actual terms of purchase of the water undertakings.

A curious species of oblivion seems to have come over Mr. Dickinson, in connection with Mr. Corbett's motion that a return should be prepared showing "the expenses "incurred by the Council in the promotion of its various "Water Bills since the formation of the Council." Mr. Dickinson is said to have pointed out that "only one "Bill had been promoted by the Council." We recollect a Height of Supply Bill, and as many as eight Transfer Bills. But parliamentary expenses do not cover all the outgoings connected with the preparation of Bills. A very considerable sum has been spent in concocting the project for bringing water from Wales. The Council have also been mixed up in certain water inquiries; and Mr. Dickinson acknowledges that several Water Bills have been opposed by the Council. We think he might have said that the Council have opposed every Bill brought forward by the London Water Companies. It might thus

be worth while to consider how much has been expended by the Companies in defending their interests against the attacks to which they have been subjected by the County Council. We may be told this is only so much taken out of the profits of the Water Companies. But it is little better than sheer waste; and even the profits of the Companies are capable of yielding some advantage to the consumer, as shown by Mr. Henry Lazarus, of St. Pancras, in a letter to "The Times." This gentleman mentions the liberality of the West Middlesex Water Company, who, after making a moderate charge for the supply, give the consumers a rebate of 10 per cent. This Company, paying their full dividend, distribute the surplus profits among the customers. If law expenses prevent the production of a surplus, of course the rebate will disappear. Mr. Lazarus argues that when the day of purchase comes, as he expects it will, it will be unfair to compensate the Companies on the basis of their dividends, as in that case those who have levied the heaviest charges will get the largest recompense. For this reason he objects to open arbitration, as likely to give the higher reward where it is least deserved. For example, the New River Company, whose ways do not please Mr. Lazarus, will be much more liberally compensated than the West Middlesex Company, who deal generously. Perhaps the latter Company will yet be content with compensation "upon the basis of "their dividends," though at the same time grateful to Mr. Lazarus for his goodwill, and for an act of appreciation so rarely extended to a Water Company.

**Lass's Analysis of the Metropolitan Water Companies' Accounts.**—As notified in another part of the "JOURNAL," the sixteenth issue of the analysis of the Metropolitan Water Companies' accounts, compiled and arranged by Mr. Alfred Lass, F.C.A., is now ready. The accounts dealt with are for the year ended December 31, 1895, and March 31, 1896; and the analytical results are presented in the same form as in previous volumes. Appended to them are particulars as to the Companies' rates of supply, their statutory powers as to dividends, and reprints of the Water-Rate Definition Act, 1885, and the Regulation of Powers Act, 1887.

**The Staines Reservoirs Joint Committee,** constituted under the provisions of the Act of last session which was noticed in the "JOURNAL" for the 13th inst., has been formed; and the first meeting was held on Monday last week. It is composed of representatives of the three Water Companies concerned—the West Middlesex, the New River, and the Grand Junction. The first-named Company have sent Mr. E. Boulnois, M.P., Mr. Hunt, and Mr. Miles; the second, Sir J. Savory, M.P., Mr. Lewis, and Mr. Prideaux; and the third, Mr. F. Tendron, Mr. Mott, and Mr. Horsley. Mr. Boulnois has been elected Chairman. It is the intention of the Committee to push on with the works with all possible expedition.

**Institution of Mechanical Engineers.**—The general meeting of this Institution is to be held at the Institution of Civil Engineers on the 4th and 5th prox., under the presidency of Mr. E. Windsor Richards. Among the business upon the *agenda* is a communication by the Research Committee on the Value of the Steam-Jacket, containing a report of an experiment by Professor T. Hudson Beare, F.R.S.E., and Mr. Bryan Donkin. The last-named gentleman, in conjunction with Lieut.-Col. English, will contribute a paper on "The Transmission of Heat from Surface Condensation through Metal Cylinders;" and Mr. M. Longridge will deal with the subject of breakdowns of stationary steam-engines.

**The Rainfall and the Metropolitan Water Supply in the Past Month.**—The report presented to the Official Water Examiner for the Metropolis (Major-General A. de Courcy Scott, R.E.) by Messrs. Crookes and Dewar, on the results of their examination of samples of water taken daily from the mains of the London Water Companies drawing their supplies from the Thames and Lea in the past month, shows that, notwithstanding an excessive rainfall in the Thames Valley, amounting to no less than 5·47 inches, as compared with an average of 2·43 inches during the last thirty years, the water was in all cases clear, bright, and well filtered. A comparison is made of the chemical composition of the water in September, 1895 and 1896—the former being one of the driest, and the latter one of the wettest months on record. Notwithstanding the fact that the organic impurities in a river water are likely to be much higher in a dull, wet season than in a bright, dry one, the purification resulting from adequate storage and filtration works was so effectual, that the influence of the very exceptionally wet and sunless month we have lately passed through was scarcely noticeable. This is shown by the quantity of organic carbon (which may be regarded as the measure of the organic matter) present in the water. In September, 1895, the mean was 0·081 grain per gallon; whereas last month it was 0·087 grain. The increase, therefore, did not go higher than the third place of decimals.

# ESSAYS, COMMENTARIES, AND REVIEWS.

## GAS AND WATER COMPANIES IN THE STOCK MARKET.

(For Stock and Share List, see p. 810.)

ALTHOUGH last week was anything but a bright time on the Stock Exchange, yet it was a good deal better than its predecessor. It opened dull and heavy, and was depressed by Continental sales. But, as usual, the atmosphere became clearer when weak operators were cleared out of the way; and the tendency grew quiet and steadier. An advance in the Bank rate was generally foreseen—the only doubt being its extent; and when that was settled on Thursday by an advance to 4 per cent., the markets seemed to be relieved by the certainty. From that point almost the only disturbing element was the approaching settlement in the more speculative departments, which may give rise to some difficulty. However, the net result is that prices on the whole closed a good deal better than they opened; and again the Americans are the chief gainers. The Money Market is strong; and the advanced rate is well backed up by the demand. It has not been a good week for Gas securities, though it would be hard to say for what reason, unless it be that a disagreeable impression was produced by the Imperial Continental incident. The municipal government of Vienna being controlled by a Socialist majority, inspired moreover by religious animosity, there is no relying upon their actions being in accordance with common sense and business principles. But, happily, the very extravagance of the course of action which they threaten to take, is so monstrous that one may fairly expect the general Viennese community to rise in rebellion, and defeat it. At home, the Metropolitan Companies have all been rather flatter. In Gaslights, the "A" was put down a couple of points, though the actual figures at which stock changed hands from day to day showed no falling off; and the opening price of 309½ was marked on the closing day. There was considerable business in the second issues, especially the 10 per cent. preferences; and most of them held their own, though one of the debenture stocks receded. South Metropolitans were done every day at a steady 146½; but the quotation was reduced a point, and the debenture was also lowered. Commercial old was also put down; but there was hardly any business done in it. The Suburban and Provincial division was unchanged. In the Continentals, there was the "panicky" drop of Imperial on Thursday to 220 (a fall of about 30 from the last previous transaction); but the next day it rebounded to 232, and on Saturday to 235. Union was also a bit lower. Among the rest, the only noticeable move was an advance in Oriental. The Water Companies had a further considerable fall all round, and closed very weak.

The daily operations were: Gas stocks were quiet at the opening; and the only change on Monday was a rise of ¼ in Oriental. Water was flat. New River fell 3; Lambeth, 2½; and East London, 2. Tuesday was more active; but movements were adverse—both Gaslight "A" and Commercial old receding 2. In Water, Chelsea fell 1; and Grand Junction, 4½. Prices kept up on Wednesday; but Imperial Continental was put down 4, and Buenos Ayres fell ½. Water was very flat. Chelsea, East London, and New River dropped 2; West Middlesex, 3; and Kent, 4½. The attack on prices was continued on Thursday. Continental Union receded 2; Gaslight 4½ per cent. debenture, 3; and South Metropolitan debenture, 3. Imperial Continental was marked down 20½. East London Water lost 3 more. On Friday, Imperial recovered 5; but South Metropolitan fell 1. Saturday was steady; and quotations closed without further change.

## ELECTRIC LIGHTING MEMORANDA.

**Electric Traction in the Newspapers—The Trolley-Wire System in America—Streets or Railway Tracks?—Professor R. H. Smith on the Prospects of Electric Lighting.**

THERE has been a good deal in the technical journals lately about electric traction. Mr. A. P. Trotter has reported with clearness and point on the proposed working of the Cape Town southern suburban tramways by electricity. Professor R. H. Smith, of Birmingham, contributed an important article on the subject to the "Engineer" of the 16th inst.—which also contained the full text of Mr. Trotter's report. The prospects of the application of mechanical traction to municipal tramways continue to exercise the local authorities and the public of several large cities; and, lastly, an interesting popular account of electric traction as realized in America appeared in last Friday's "Daily Telegraph." The last article is likely to find more readers than any of the other additions to the literature of the subject; and therefore it is satisfactory to be able to commend it as a very good piece of journalistic work—not written by an expert, of course, but still giving a sound and, on the whole, reliable account of the matter. The most striking feature of the American electric tramcar service is the high speed at which the cars are driven. "From Saratoga to the Springs we went three miles in twelve minutes, or fifteen miles an hour. This was fairly safe—being away from public thoroughfares, for the most part. But in Providence, Rhode Island, within eighteen inches of the foot pavement on one side, and the same distance from a row of trees on the other, we

rattled along as fast, if not faster. Up and down hills the electric cars dash along at railway speed, in places where horse traction would be impossible." It is not only the tramway service that is worked in this way. "In Baltimore, I saw a 96-ton electric locomotive hauling huge goods trains through a tunnel under the town; and in New York they have just put on the Manhattan Elevated Railroad an electric engine of similar dimensions." Very naturally, the writer wonders when partial suffocation will be banished from our underground railways by the noiseless and smokeless electric current.

It is admitted that "at home we should object to the overhead wires by which the current is conveyed to the car motors. They are unsightly, highly dangerous when they break, and a serious obstacle to the movement of fire-escapes. In Boston they form a hideous disfigurement to the very best quarters of the city. Still more should we protest against a speed varying from twelve to twenty miles an hour in and across crowded thoroughfares." We read further that a beginning has been made with underground conductors for electric cars in central New York and Washington—in the latter case with complete success, in the former not so satisfactorily. The reporter "thought the electric cars in Washington the best in the city, the freest from jolting, and the most completely under control." The expense of the installation is large; but it is claimed that the cost of working is not more than one-half that for horse, and two-thirds that for cable traction. The writer wonders again why "the land which has done more for the science of electricity by the labours of Faraday, Kelvin, and Clerk-Maxwell than all others, should lag behind in its practical applications," and calls on experts to explain.

It does not occur to this excellent observer that he has himself gone far to supply the explanation he asks for—at least as regards tramway working. The average American tramway is really a street railway; and the average American citizen is content to have it so. He does not regard his city streets in the same light as do the residents in these riper lands the thoroughfares which they call by the same name. To the American, the street is primarily and almost wholly an avenue for locomotion. "The New Yorker, the Bostonian, the Philadelphian, the Pittsburger, when his day's work is done, wants to get to his suburban home as quickly as possible; and elderly, short-sighted, moping, and absent-minded people had better keep out of the way. For all such in these towns, and still more in Chicago, suicide must have become a lost art. Providence and the police are supposed to protect the children, which protection, I can vouch from experience, is not always successful." Exactly so—the distinction between a street and a railway track, which seems so obvious and natural in other lands, has been lost to the American, if he ever realized it. He has been robbed of his streets; and his cities are thus deprived of what in other countries is one of their greatest charms—to nobody more than to the American visitor. Where Americans have not lost all sense of what is due to a town, as in Washington, the trolley wire has to go underground. If it suits American ways to spoil other cities, we do not know why anybody else should complain. Americans come away from them whenever they can afford to do so, and display a remarkable faculty for appreciating life in cities where the streets are actually all that the term implies. Only there is no particular reason why one should call the electrical spoiling of streets by the name of "enterprise."

Professor Smith's article confesses that electricians are likely to find more profit in the traction department than in lighting. He says "there are very evident and somewhat narrow limits to the business of electric lighting by present methods; and the growth of invention in incandescent gas lighting is likely to make these limits a great deal narrower than had been hoped for by electricians a few years ago. Estimates were recently made for the radical and liberal improvement of the lighting of a large installation at present illuminated by ordinary gas-jets. It was found that the outlay required for the desired results by electric plant would be from eight to ten times that needed if incandescent gas-lamps were employed; while the annual cost in interest, depreciation, &c., wages, and materials, would be with electricity more than double that with incandescent gas." More remarkable still, it was found that incandescent electric lighting could not satisfactorily replace oil-lamps for lighting a certain engineering station. The attempt was made to generate the electricity by means of oil-engines; and the result was that the engines used more oil than the lamps previously employed, while the lighting effect was not nearly so good as before. For power transmission and traction purposes, Professor Smith regards the future of electricity as practically illimitable.

**"Bearings and Lubrication."**—Every user of machinery is interested in the above subject, which has been dealt with in a handbook by Mr. A. J. Wallis-Tayler, Assoc.M.Inst.C.E., just issued by Messrs. W. Rider and Son, Limited, of Bartholomew Close, E.C., as one of their "Technical Series." The author very pertinently remarks that it is not work, but friction, that causes machinery to wear out; and therefore it behoves those who have charge of it to make a judicious selection of the best lubricators. Upon this depends diminished wear and tear, and consequent economical working. This should be the aim of every mechanical engineer and works' manager, who will find in Mr. Tayler's book much that will be of service to them.

## THE FUTURE OF PRODUCER GAS.

In the August number of the "Engineering Magazine," Mr. A. Humboldt Sexton discussed the future of producer gas with much insight into the character of the method of firing in question. He holds that this description of fuel has an important future before it, particularly in connection with the development of the gas-engine; and this belief is strengthened rather than weakened by full recognition of the fact that producer gas has hitherto somehow failed to take the position in manufacturing industry that its advantages appear to warrant. Mr. Sexton allows it a universal use in the open-hearth steel manufacture; and he admits its employment in a few other operations in which high temperatures are required. He declares, however, that "in the majority of our manufactures it is very little used, and for steam raising and similar purposes its value has hardly been recognized." Yet for many purposes as he says—probably for most—gaseous fuel has very decided advantages over the solid combustible, both as regards convenience and economy. "That the importance of these advantages has not been fully realized, is evident; and for this there must be some good reason. Is it that the manifest advantages of gaseous fuel are accompanied by some less obvious disadvantages, which to ordinary fuel-users more than counterbalance them? If so, are these disadvantages inherent in the fuel itself, or are they due to the use of unsuitable and defective forms of plant? Or is the neglect due merely to innate conservatism, which makes most people loth to change the methods of work to which they have been accustomed?" Mr. Sexton replies to his own queries in the sense that it is to the unsuitability and defective character of much of the producer-gas plant that has been used that the slow progress of the system must be attributed. He says: "Unfortunately, very few of the gas producers at present in use allow anything like a full realization of the convenience and economy of gas-firing."

Then follows a criticism, with examples. Mr. Sexton aptly observes that, studying the various patents which have been taken out for gas-producers, one is at first appalled by their number. But this feeling is soon replaced by one of wonder at the extraordinary lack of originality shown by the patentees, and at the evident ignorance of most of them of the principles on which gas production is based. Most inventors seem to content themselves with merely modifying or improving (?) in details forms of producers already in use; very few going back to first principles, with the object of applying them in the best manner to the purpose in view. Too often, also, pains are wasted in the attempt to make a perfect gas-producer for general application, regardless of the fact that what is best for one purpose may be worst for another, and that it is impossible to design any form of plant which will be equally good under all conditions.

Let us pause here in order to remark that, so far as experience in the industry of gas lighting goes, it strongly corroborates Mr. Sexton's contention. He does not mention the modern adoption of gaseous firing for the heating of gas-retorts. Perhaps he knows nothing of this circumstance; and, if so, he will be all the more pleased to hear that it was not until thirty years or so after the first suggestion of this method of heating retorts had been made, with unsatisfactory results, that a better adaptation of the principle to the particular case was effected. There are probably more gas-producers in use in gas-works to-day than in any other manufacture. So far as promulgation of the principle goes towards bringing about this result, there is no apparent reason why this should not have been as true of the gas-works of thirty years ago as it is of contemporary gas manufacture. The secret of the change lies in one word—specialization. Success lay not in making producer gas, but in making it so as to be useful for, and applicable to, the particular purpose.

To return to Mr. Sexton's article, which proceeds to describe the earliest or Siemens type of gas-producer. He shows that, assuming the producer to work perfectly, the resulting gas would contain 34·7 per cent. of combustible in the form of carbon monoxide, and would have a very low calorific power and be extremely wasteful of the raw material. This, it may be remarked, is the way in which the calorimetrists—who kept the science of pyrology in leading-strings made in the laboratory until Frederick Siemens arose to break them—used to teach the lesson of the wrongfulness of burning carbon to carbon monoxide. These teachers did not know anything about the possibility of heat-recuperation, nor the practical advantages of having heat for industrial purposes where it was most wanted. Nevertheless, it is true that Siemens gas is a poor combustible, incapable even of igniting if once allowed to get cold. It is highly desirable to enrich it; and this can be done by the addition of steam to the fuel in process of gasification. If a producer could be kept going by steaming it alone, without adding any air, the gaseous product would be all water gas. But this cannot be done, because of the absorption of so large a quantity of heat by the steam. Hence the amount of steam that can be used in a continuous gas-producer is limited; but by the judicious use of the proper quantity, the loss of heat in the producer may be reduced to about 15 per cent. of the heating power of the fuel—something like half the loss under the same head of the Siemens gas-producer.

The sources of loss of heat in gas-producers are: (1) Undue evolution of heat in the producer itself by the fuel being burnt

to carbonic acid. (2) Sensible heat carried away by the gases, by radiation, lost in the ashes, and used in gasifying the charge. It is obvious that the losses of the producer can never be reduced to nothing, which would mean the realization of perfect efficiency. Hence the heating power of the gas is always less than that of the raw fuel from which it is made, by a figure which represents the waste of production. It does not follow, however, that gas production is therefore less economical than burning the fuel direct to carbonic acid, because the latter, from the defectiveness of furnaces, and so forth, may be a far more wasteful way of consuming the fuel. It actually is so in many cases—as, for example, in gas-retort furnaces, where the intense local effect of the complete combustion of the solid fuel cannot be properly utilized. On the other hand, in cylindrical and locomotive boiler furnaces, and for other purposes where all the local effect of the fuel is taken advantage of, the economy of direct firing is at its maximum, while that of gas firing is comparatively low. This is an order of considerations which appears to have escaped Mr. Sexton.

The author passes in review the best-known types of gas producer, and concludes that the nearer the simple form of producer—that is, the apparatus invented by Siemens and improved by Wilson, Dowson, and others—approaches to the pattern of the blast-furnace, the better it will be. He regards the blast-furnace as in many respects an ideal gas-producer. "The gas from an ordinary iron-smelting blast-furnace contains a large quantity of carbon dioxide produced by the reduction of the iron oxide; but even then it compares favourably with some producer gases, and can be used for all purposes for which gaseous fuel is required, including steel making in open-hearth furnaces and driving gas-engines. If there were no reducing reactions to take place, the gas would contain no carbon dioxide. In ordinary producers, the ashes are drawn out solid; in a blast-furnace producer, they are melted and tapped out. The fluxing of the ashes might necessitate the addition of a small quantity of limestone; but the carbon dioxide from it would probably be decomposed at the temperature at which it was separated." Mr. Sexton does not claim to be the first to take this view of the blast-furnace, but admits that Mr. Ormiston, of Glasgow, published a pamphlet on the subject some years ago. True, the blast-furnace is a grand gas-producer; but, unfortunately, like the coke-oven, of which the same can be said, there is no use for this product as fuel in the ordinary situation of such furnaces.

Mr. Sexton mentions the new Siemens double-effect gas-producer, and also the Mond producer with ammonia recovery, to which he appears to be strongly attracted. His essay is a good and instructive one; but he does not advance our knowledge of the possibilities of gas-producers, nor show any direction in which, by suitable modification, producers might be made more useful than is at present the case. He does not attempt, for instance, to answer the question as to whether producer gas is likely to be more used in steam raising than it is now, or whether steam raising for power purposes is more likely to be superseded altogether by the increased use of gas-engines driven by producer gas. The largest scale on which, to our knowledge, producer gas has ever been applied in steam raising was in the disastrous Birmingham compressed air power distribution scheme, when it did not turn out at all an economical way of firing a battery of boilers. Our own persuasion is that gaseous firing cannot compete in boiler furnaces with direct firing, whether the fuel in the latter case is solid or liquid; while it is probable that there are many other industrial uses to which the former class of fuel may yet be successfully applied. For the production of power, it is obviously preferable to discard the steam-boiler altogether, when this can be done; using the fuel gas directly in a gas-engine.

## WATER ACTS FOR 1896.

(*Concluded from p.* 739.)

THE Manchester Corporation Act contains a clause amending section 5 of the North Cheshire Water Act, 1864, so as to include within the Corporation water limits the townships of Partington and Carrington, which are in the parish of Bowden, Cheshire. From and after the passing of the Act, all powers and obligations on the part of the North Cheshire Water Company to supply water within the townships cease and determine.

The Borough of Portsmouth Water-Works Act enables the Borough of Portsmouth Water-Works Company to take additional lands, and construct works comprising an alteration and diversion of the Bedhampton stream, the making of a new watercourse or drain, and the laying of pipes to take the waters of Bedhampton spring and Bidbury ponds. For the protection of the Havant District Council, it is enacted that the alteration of the watercourse in question is to be carried out by means of a 5-feet culvert. Other provisions are made in the interest of the Havant District Council, and of the patron and owner of the living of Bedhampton. The works are to be completed within seven years.

The Padiham Urban District Council (Water) Act extends the time allowed by an Act of 1889 for the construction of the reservoir thereby authorized, to fifteen years from the termination of the original period. Certain powers granted to the Local Authority by an indenture dated Nov. 1, 1892, relating to the digging of clay for the construction of the reservoir, are also extended to the same period.

The Rotherham Corporation Act contains a part relating to water supply. This authorizes the construction of an additional well and pumping-station in the parish of Whiston. An agreement between the Corporation and the Greasborough District Council for the supply of water to the latter for a period of twenty years, at the price of 9d. per 1000 gallons is scheduled and confirmed. The time allowed for the completion of the Dalton reservoir is extended to May, 1910. Persons aggrieved by such enlargement of powers may have compensation for any additional damage caused thereby. In the event of any local authority within whose district any pollution of the source of supply may occur, refusing or neglecting to deal with the same by enforcing the provisions of the Rivers Pollution Prevention Act, 1876, the Corporation may act as though they were the Local Authority—paying their own costs. For the protection of the West Riding of Yorkshire Rivers Board, the Corporation are required to furnish the Board with particulars of their proposed sewage purification works. For the protection of the West Riding County Council, it is enacted that water-mains must be laid at the side of roads; and they are to be carried over streams by means of wrought-iron riveted tubing, independent of the structure of any road bridge. The same conditions apply to roads under the control of the Rotherham Rural District Council. The sum of £30,000 is to be applied to water-works purposes, repayable in fifty years.

The Sheffield Corporation Water Act empowers the Corporation to construct works for impounding the waters of the River Porter or Little Don and its tributaries, to supply water to the Corporations of Rotherham and Doncaster, and to acquire the water undertaking of the Stocksbridge Urban District Council. The preamble of the Act rehearses the circumstances which led to parliamentary action with regard to the Little Don water by the Corporations of Sheffield, Doncaster, and Rotherham. Additional lands may be taken for water purposes by the Sheffield Corporation within five years; and within twelve years the Corporation may construct two reservoirs, to be called the Langsett and Underbrook reservoirs respectively, to impound the waters of the Little Don River, together with the necessary subsidiary works and connections. Clauses are inserted for the protection of the West Riding County Council and the Rotherham Rural District Council, providing among other things for the water-mains to be laid as far as is reasonably possible at the sides of roads. The waters of the Little Don River, as well as of twelve named brooks, cloughs, and becks, are to be taken; and also, in addition thereto, those of the Hagg Brook, subject to the provisions of the Barnsley Corporation (Water) Act already abstracted (*ante*, p. 738). Compensation water is to be discharged below the Langsett reservoir at the daily rate of 1,750,121 gallons from Mondays to Fridays inclusive; 1,709,733 gallons during Saturdays; and a night flow from Sundays to Fridays of 1,166,748 gallons, with 1,050,073 gallons during the period between the cessation of the day flow on Saturdays and the commencement of the night flow on Sundays. Modifications of the scheme of compensation discharge are provided against various eventualities. For the purpose of executing any necessary work of repair, or for cleansing or examining any authorized aqueduct or pipe-line, the Corporation may temporarily discharge the same into any available stream or watercourse, subject to the liability to pay for any damage done thereby. The penalty for failure to carry out the compensation water requirements is £20 per day, recoverable by every occupier entitled to the use of the water. No more water than the Corporation were previously entitled to take is to be appropriated under the Act until the prescribed quantity of compensation water has flowed for six consecutive days over the gauges; and the Corporation are forbidden to take at any time or to divert or impede the waters of the Little Don or its tributaries below the lowest gauge for the time being certified. For the regulation of the proceedings of the millowners under the Act, any three of them may convene a meeting in Sheffield, at which a vote may be taken concerning the business before them. Every millowner entitled to vote is to have one vote in respect of every entire foot of head and fall of water of or belonging to every mill or water-wheel in respect of which he is entitled to vote. The associated millowners may appoint an engineer, a clerk, and persons to inspect the gauges. The Corporation are to contribute £20 a year towards payment of the salaries and expenses of these officers; any excess to be paid rateably by the millowners. The Corporation are to make good all damage caused by failure of the reservoirs and works. The water supplied by the Corporation under the Act is to be properly and efficiently filtered or otherwise treated so as to prevent it from acting on lead in such a manner as to endanger the health of the consumer. For the protection of the Earl of Wharncliffe, as owner, it is enacted that the Corporation shall not exercise any of the powers of the Act for the supply of water in bulk or otherwise within any part of the Wortley and Carlton Estates, if and so long as such estates are supplied with water from the water-works of the owner, without first obtaining his consent in writing. Water is not to be supplied within the limits of the Dewsbury water authorities. The Corporation are authorized to borrow £800,000 for the purposes of the Act, by the issue of new redeemable stock. A

separate loans fund is to be established in respect of this new issue, which is to be distinct from the original Sheffield Corporation consolidated loans fund. Money raised to defray the costs of the Act is to be paid off in ten years; that raised for the purchase of additional meters, within twenty years; and the remainder of the new loan, within sixty years—commencing on March 31, 1902. Special provisions are made in respect of the sinking fund. The amount of the reserve fund is altered from £50,000 to £150,000. Agreements between the Corporation and the Corporations of Rotherham and Doncaster are scheduled and confirmed. These Corporations are authorized to borrow, with the sanction of the Local Government Board, such sums as may be required for the purpose of carrying the agreements into effect. The Acts of the Rotherham Corporation relating to water supply are amended, to make provision for the exceptionally heavy expenses incurred by the Corporation and their predecessors on water-works account by reason of the great difficulty of providing a supply for their district, by reducing the amount of the yearly contributions to the sinking fund, and increasing the domestic water-rate from 7 to 8 per cent. The agreement between the Sheffield and the Barnsley Corporations is scheduled and confirmed. With respect to the acquisition of the water undertaking of the Stocksbridge Urban District Council, the ordinary purchasing powers are conferred upon the Corporation; and an agreement is scheduled whereby the Corporation engage to pay £10,000 for the undertaking. As soon as the Corporation are in a position to fulfil their engagements to the Corporations of Rotherham and Doncaster, they are also to supply water in bulk to the Urban District Council of Swinton, the Rotherham Rural District Council, and the Wortley Rural District Council, in such quantities as may be required up to 20 gallons per head, at a proportional charge of 4 per cent. on the capital costs. The Sheffield Corporation and their present district of supply are at all times to have a prior right to 25 gallons per head of the population. Two agreements between the Corporation and Messrs. Samuel Fox and Co., Limited, the owners of large steel-works on the Little Don River, and the largest and first consumers of its waters, are scheduled and confirmed.

The Yeovil Corporation (Water-Works) Act authorizes the construction of additional water-works consisting of certain pipe-lines and a service reservoir, to be completed within five years. The sum of £10,000 is to be borrowed for the purchase of land and the execution of the authorized works, repayable in fifty years.

The Ystradyfodwg Urban District Council (Gas and Water) Act authorizes the Council to acquire the water undertaking of the Ystrad Gas and Water Company. Additional works are to be constructed, including an embankment for the purpose of raising the level of the water of Lake Llynfawr, filter-beds, service reservoirs, and pipe-lines. The waters of numerous tributaries of the Rivers Neath and Rhondda are to be taken, subject to provisions for the protection of the Earl of Dunraven, and of several colliery companies. The works are to be completed in seven years. The limits of supply are defined; and the supply itself is to be constant. The rates for domestic supplies are 1s. 4d. in the pound for premises under £20, and 1s. 2d. in the pound when the rateable value is higher than this figure, with extras. Baths containing more than 50 gallons may be charged for at a proportionately increased rate. The District Council are not to supply water in the district of the Pontypridd Water-Works Company. The sum of £87,000 is to be applied to the purchase of land and the construction of the authorized water-works, repayable in forty-five years. It is enacted that a contractor for water supply is not to be disqualified thereby from being a member, officer, or servant of the District Council; but any member of the Council concerned directly or indirectly by himself or any partner in any such contract, except with respect to a domestic supply, shall not take part in any proceeding relative thereto at any meeting of the Council.

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The following Act does not come within the category of Acts relating to water supply of the ordinary kind: The London Sea Water Supply Act incorporates a Company with a share capital of £600,000 and power to borrow £150,000 when all the capital is issued and accepted and half paid, for the purpose of supplying London with sea water from an intake in the parish of Lancing, Sussex, at a point seven miles from Brighton. A reservoir and pumping station are to be constructed there, and the necessary pipe-line and reservoirs are sanctioned for connecting these works with London, which is to be reached through Battersea. No interference with a London street is to be permitted until the Company have satisfied the London County Council that the works from Lancing to London are completed. Before commencing any street-main laying, the Company must deposit with the highway authority a sum of money sufficient to cover the estimated cost of reinstating the surface, including the cost of supervision; and such money may be retained until the ground is thoroughly consolidated. Sea water required by any Vestry or District Board for street watering is to be supplied at the same cost as fresh water. The Act does not give the Company any exclusive privilege of supplying sea water in London; and any Bill for the purchase of the undertaking by a local authority is not to be generally opposed. Before commencing any works in the City of London, the Company will be required to satisfy the Corporation of their ability in every respect to complete them. Clauses for the protection of London Vestries, landowners, the Commissioners of Works, and the Railway, Water, and Gas Companies, make up the bulk of the measure. The authorized works are to be completed within seven years. The sea water is to be supplied to private consumers at a price not exceeding 5s. per 1000 gallons. The Company may supply it in bulk to any local authority or company, and may build and maintain baths. No parliamentary deposit in respect of any Bill that may at any future time be promoted is to be paid out of the Company's authorized capital.

## OBITUARY.

The death of Alderman JOHN SHERWOOD, at his residence, Tower House, Folkestone, on the 17th inst., in his 72nd year, creates a vacancy on the Boards of the Folkestone Gas and Water Companies. The deceased was for some years Chairman of the latter Company. He was a Justice of the Peace, and had been several times Mayor.

## PERSONAL.

Mr. W. WHITAKER, F.R.S., who joined the Geological Survey of Great Britain in 1857, has resigned his position on the staff. He was for many years engaged as District Surveyor, in superintending the survey of the Southern Counties of England, and was much respected by his colleagues.

Mr. D. F. DRAYTON, who has been for some years in the service of the Georgetown (British Guiana) Gas Company, has been appointed Manager of the works, in succession to Mr. T. B. Younger, whose relinquishment of this position was notified in the "JOURNAL" some weeks ago.

Mr. JAMES C. WATSON, assistant to Mr. Charles Gandon, of the Crystal Palace District Gas Company, Lower Sydenham, has been appointed Assistant Manager of the Oriental Gas Company's works at Calcutta—an appointment advertised in the "JOURNAL" for the 22nd of September as about to become vacant.

Mr. A. HOWARD has been assigned to the position of gas examiner at the Lambeth Road testing-station of the London County Council, in succession to Dr. W. Lapraik, whose death was noticed in the "JOURNAL" a fortnight ago. Mr. Howard was appointed one of the relieving gas examiners of the Council in June, 1893.

On Friday, the 16th inst., a complimentary dinner was given at the Holborn Restaurant, by the officers of The Gaslight and Coke Company, to Mr. HENRY YOUNG (late Divisional Chief Inspector for the Southern Division), upon his retirement from the Company after 35 years' service. The chair was taken by Mr. G. F. L. Foulger, the Company's Distributing Engineer. During the evening, a silver tea and coffee service was presented to Mr. Young; the salver bearing the following inscription: "Presented to Henry Young, Esq., by his Brother Officers, on his Retirement from the Position of Divisional Chief Inspector in the Service of The Gaslight and Coke Company, as a Mark of their Esteem and Regard, 16th October, 1896."

In celebration of the marriage of Mr. C. C. CARPENTER, which took place last Thursday, a number of his professional friends, members of the Institution of Gas Engineers, decided to manifest their regard and esteem for him by making a presentation. It was ascertained that a microscope, with table and accessories, would be highly appreciated by Mr. Carpenter; and accordingly one was purchased and forwarded to him with a list of subscribers and a letter from the President of the Institution (Mr. W. Foulis) asking his acceptance of it from them with their congratulations and best wishes. The microscope (which is one of Messrs. R. and J. Beck's "National" type) and table bear the following inscription: "Presented to C. C. Carpenter, Esq., M.Inst.C.E., upon the Occasion of his Marriage, 22nd October, 1896, by a few Personal Friends, Members of the Institution of Gas Engineers." The secretarial work in connection with the testimonial was carried out by Mr. Alfred Colson, of Leicester.

Mr. WILLIAM M'CRAE was on Friday last promoted by the Dundee Town Council, from the position of Assistant Manager at the Corporation Gas-Works, to that of Engineer and Manager, which was rendered vacant by the recent death of his brother, Mr. John M'Crae, as recorded last week. Mr. W. M'Crae has been associated with the Dundee Gas-Works during the whole of his business life. He was born at Airdrie, where his father was Gas Manager, and went to Dundee when his father was appointed to the managership of the works there. He was educated at the High School in the city, and studied chemistry under Mr. F. W. Young. After leaving school, he was apprenticed to his father, and passed through all the departments of the works. He was then appointed Assistant to his brother, a position which he has held for more than twelve years. During his connection with the works, they have been almost entirely remodelled and extended; and they are now nearly one-third larger than they were when he first became connected with them.

## NOTES.

### The Electrolytic Corrosion of Gas-Mains.

A detailed report by Mr. A. P. Trotter on the Cape Town Southern Suburban Tramways, recently published, gives the latest independent criticism of the applications of electric traction to tramways, and deals specifically with the corrosion of gas and water pipes. Mr. Trotter admits that, before suitable precautions were taken to avoid electrolytic corrosion, serious damage was done in this way. At Cambridge, Massachusetts, after electric tramways had been started, lead pipes quickly began to disappear—some even in six or eight weeks. Iron and brass pipes went in the same way. At Saginaw, Michigan, gas-pipes were eaten away in two or three months. Mr. Trotter goes on to say that a remedy has been found for this corrosion; but it can only be said to be a partial remedy. The Board of Trade, in regulations made to prevent such corrosion, orders that a continuous record shall be kept of the difference of potential during the working of the railway between the point of the uninsulated return farthest from and nearest to the generating station. This difference is never to exceed seven volts. Mr. Trotter has given this regulation his very careful attention; and he thinks in the case of Cape Town it may safely be made less stringent. Here tram-rails are carefully bonded together with copper connections. This will greatly reduce leakage; and it is considered that by maintaining the trolley wire at a positive potential, and the rails at a negative potential, and, if necessary, by connecting the neighbouring pipes to the rails, corrosion will be checked, and interference with telegraphs and telephones will be prevented. It is to be noticed that Mr. Trotter does not commit himself to anything beyond checking the corrosion—a prudent reserve which accentuates his previous observation that only a partial remedy has yet been found for the mischief in question.

### "Nitragin."

Messrs. Meister Lucius and Brüning, of Hoechst-on-Main, have forwarded some further particulars, with a sample, of the new germ preparation, "Nitragin," of Drs. Nobbe and Hiltner, intended to promote the fertility of soils for leguminous crops, as first referred to in the "Notes" in the "Journal" on the 29th ult. It should be understood that, though put up in commercial form, this preparation is not as yet being stocked in England; so that it still ranks as a novel scientific curiosity. Its appearance as a marketable fertilizer is, however, only a question of a short time, as the firm have already accumulated a great deal of experimental proof as to the value of this means of fertilizing otherwise barren soils. The correctness of the principle involved is completely established. Leguminous crops enrich the soil with nitrogen obtained from the atmosphere by the agency of a bacterium that resides in the characteristic nodules on the roots of this family of plants. If these bacteria are not present, the plant cannot utilize the atmospheric nitrogen; and its growth is not only consequently stunted, but the soil is impoverished. It therefore becomes of prime importance for all cultivators of the legumes to make sure that the soil in which the crops are to be grown contains a supply of the necessary bacteria, without which unmanured land will yield but poorly, while even land heavily manured with sulphate of ammonia or nitrate of soda will not give the full advantage of his outlay to the cultivator. "Nitragin" is offered as a certain means of inoculating the soil with the right kind of bacteria. It is put up in bottles, one of which is enough for the treatment of 2½ roods of land. The preparation is in the form of a gelatine-cultivation, which readily liquefies at the temperature of the human body, beyond which it must not be heated. Neither must the medium be exposed to direct sunlight, which would kill the bacteria. The liquefied medium is diluted with sufficient clean water to moisten the seeds, or else mixed with the earth to be inoculated. Thus the method of applying the nitragin is extremely simple. Eight varieties of the preparation are already specified for application to different species of leguminosæ.

### The Best Iron in the World.

Mr. E. Windsor Richards recently inaugurated the metallurgical department of the Glasgow and West of Scotland Technical College with an address on "Best Yorkshire Iron, and How it is Made," which is interesting on many accounts, and especially as testifying to the continued usefulness of the splendid iron manufactured at Lowmoor for upwards of a century. Though the present is spoken of as being pre-eminently the Age of Steel, there are no signs that Lowmoor iron is in danger of losing its place in the industrial arts. After describing how this iron is made, refined, and puddled, Mr. Richards claimed that the product has attained its high reputation by reason of its power to withstand many sudden shocks without fracture, its reliability, and its welding properties. When used in a plate ¼ inch thick, such iron will stand 23 tons tensile stress with the grain, and 16 per cent. elongation; and 20 tons across the grain, with 12 per cent. elongation. A plate 1 inch thick will stand 22 tons with the grain, and 20 tons across. A sample round bar 1⅛ inches in diameter had a contraction area of 60 per cent. Its breaking stress was 22·9 tons per square inch, with 32 per cent. elongation in 8 inches. Bars 2½ inches square should bend cold upon themselves without showing any signs of rupture on the curved edges. Mr. Richards admitted that mild steel, or ingot iron, has displaced Lowmoor iron for many purposes, as may well be the case, seeing that steel plates cost only one-fourth the price of Lowmoor sheets. The demand for the best iron in the world for bars, rivets, and chains remains good, and is likely to continue, with our present knowledge of steel making.

### Questions Concerning the Ether.

It has been remarked, with much point, that the ether of modern physical science fared so very badly at the Liverpool meeting of the British Association, that little more additional burden will break the back of this heavily-laden hypothesis. The President of the Mathematical and Physical Science Section—Professor J. J. Thompson—devoted a good deal of his address to the bearings of etheric theory upon the latest experimental advances in the debateable land between light and electro-magnetism. He discussed the cathode and Röntgen rays in connection with the theory, and concluded with a reference to Oliver Lodge's heroic attempts to lay hold directly of the ether, if it exists as something capable of being set in motion by the movement of a solid body. These attempts have had only a negative result; and Professor Thompson observed that, while there is nothing in the electro-magnetic theory of light to preclude vibrations of the ether resulting from mechanical forces, it is necessary to assume that the ether is at rest in order to avoid having too many unknown quantities to deal with. Lord Kelvin has frankly confessed that all his attempts to attain to a satisfactory understanding of the physical nature of the ether have failed. Discussing the position, a writer in "The Times" has observed that "while there is no slackening of zeal in experimental investigation, the proceedings at Liverpool were not so much a report of new and startling discoveries in the domain of experimental research as a council of war touching theoretical points. Every day the results of experiment declare with greater force the inadequacy of our theories." The great question of physical science discussion is declared to be: What shall be done to the ether, which has been a good servant, but has narrowly escaped being a bad master? A writer in the "Engineer" argues that all this trouble comes from accepting the concept that all phenomena of every kind, and our perceptions thereof, are modes of motion; and he suggests that while good within limits, this idea may not be the whole truth.

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**The Institution of Junior Engineers.**—The annual general meeting of this Institution was held at the Westminster Palace Hotel on the 16th inst.—the retiring Chairman (Mr. M. J. Young) presiding. The Council's report, which was read by the Secretary (Mr. Walter T. Dunn), showed that the total membership was 454—an increase of 36. Mr. A. R. Binnie, M.Inst.C.E., is the President for the current year. Seven meetings were held last session for the reading and discussion of papers, and eleven visits to works were made. The summer meeting in Scotland was highly successful. The report contained a copy of the address of congratulation presented to Lord Kelvin, one of the Vice-Presidents of the Institution, on his professional jubilee. A vote of thanks was passed to the retiring officers for their past services. The new Chairman is Mr. H. B. Vorley; and the Vice-Chairman, Mr. Basil Joy.

**The Secret Commission System.**—Reverting to this subject, the "Pall Mall Gazette" last Thursday noted with pleasure that the exposures which have recently taken place of the prevalence of secret commissions has induced the London Chamber of Commerce to take the matter up. Our contemporary says: "A representative Committee has been appointed to inquire into the subject, and doubtless to lay their findings before the Chamber, which will then take such action as may seem expedient. It is not to be expected that what may then be done will have any immediate effect; for the most the Chamber can do is to throw more light on the practices in question, and thus point the way for some remedial scheme." The widespread nature of the practice which has been exposed to such searching criticism in our columns is shown by the fact that the subject has been taken up by other publications connected with some special branch of industry. For example, the "Drapers' Record" recently made the following remarks: "It would be quite easy to strengthen the law—or rather arm it with another weapon—by making the payment and receipt of secret commissions a criminal as well as a civil offence, as recommended by Sir Edward Fry. We should be inclined to support such a change in the law, because we regard secret commission giving and receiving as a very serious evil indeed, eating into the very heart of commercial life. But while we should confidently look for some result in the shape of a diminution of the malpractices, we should not expect to see them entirely discontinued, as a consequence of the increased rigour of the law. For the chief difficulty to be overcome is that of detection. It is an axiom of the criminal law that the prevention of crime is best attained by making its punishment sure rather than severe. In the case of secret commissions, the two principal parties concerned are generally the only persons cognizant of the transaction; and the interests of both are so bound up in the preservation of secrecy, that the chances of the truth leaking out are reduced to a minimum."

# TECHNICAL RECORD.

## THE GAS EXHIBITS AT THE BERLIN INTERNATIONAL EXHIBITION.

In the "JOURNAL" for July 21, we published a few notes on the Gas Section of the Industrial Exhibition in Berlin, compiled mainly from the reports by Dr. H. Lux which appeared in a German contemporary. As the Exhibition is now closed, we give some additional particulars, for which we are indebted to an esteemed correspondent who has recently returned from Berlin.

Referring first to the building in which the gas exhibits were displayed, our correspondent says it suffered considerably by comparison with the Gas Pavilion at the Paris Exhibition of 1889, the plans and elevation of which were given as a supplement to the "JOURNAL" for March 12 of that year. The clear classic features and charming position and surroundings of that structure, partially veiled as it was by fresh green foliage, left upon the memory of the visitor a beautiful picture which could scarcely fail to be recalled at the Berlin Exhibition, where the home of the gas exhibits was little more than a shed, with a vulgar peep-show of outdoor spectacular amusement in the shape of a painted canvas representing snow-capped mountains. But however much the lofty idea of the late Prince Consort, as embodied in the remarkable building which sprang up, under the genius of Sir Joseph Paxton, in Hyde Park in 1851, may have fallen short of realization, the resources at the disposal of the two bodies who promoted the Gas Sections at the Paris and Berlin Exhibitions must be taken into account in looking at the results of their labours. In the former case, a substantial guarantee fund was started, to which the Paris Gas Company contributed 80,000 frs., and other companies (among them the Imperial Continental Gas Association and the European and Continental Union Gas Companies) subscribed 10,000 frs. each; in the latter, it was due solely to the patriotic zeal of the German Association of Gas and Water Engineers that the progress of the gas industry was illustrated and its interests promoted. And it must be acknowledged that they did their work well. Their exhibits were judiciously arranged in a semi-circular building, which was made the head-quarters of the Association, whose courteous and devoted representative was Dr. Lux.

In previous issues of the "JOURNAL," the general nature of the exhibits has been noticed. Our correspondent states that the greatest attraction, when lighted up, was the exhibit of the German Incandescent Gas Light Company. Here, very wisely, the lights were shown as in use in tastefully furnished chambers. There was a counter full of "all sorts and conditions" of burners —from the oldest and most common to the latest developments of this interesting and brilliant light. An arc of mounted lights—a "float" stretched across and bounding the whole exhibit—was very effective. An exhibit of lanterns could claim some novelty. The hall was a huge octagon lantern to exhibit other lanterns of all shapes and sizes. Messrs. Elster, of Berlin, had an attractive and interesting show of meters, governors, testing-holders, valves, pressure-gauges, &c. These articles, together with others more or less important, made an impressive exhibit. The goods were well proportioned in design, and mostly well and tastefully finished. The exhibit of Messrs. Pintsch was less attractive.

Though there was a good show of meters of all sizes, there was no great novelty in those of any of the makers. The Warner and Cowan system, and modifications of the same principle, were to be seen. Penny-in-the-slot indexes, in several combinations, were also on view. A double-hinged diaphragm, similar to one patented by a Mr. Hyams many years ago, and made by Mr. George Bower, of St. Neots, was also shown as a novelty. The object of the invention, it was said, is to entirely empty the chambers at each discharge. The valve used in this meter is a slide, long and very narrow, instead of being nearly square in plan. None of the meters exhibited appeared to have the finish of those supplied to Continental Gas Companies by English makers many years ago.

Of gas-stoves there was an excellent display. It scarcely need be stated that the castings were good, as the Exhibition was in Berlin. Of castings in general it may be said that there were many beautiful specimens, both in design and execution. In brass-finished goods, too, there was to be found some excellent work. The models appeared in many cases to be after the English type.

Close to this section, there were two gas-motors on rails. Or it should rather be said that there were two carriages on short lengths of rails—one a movable tender; that is to say, a carriage with a gas-engine, pumps, and cylinders for storing, and feeding the other carriage, with which it was not connected and which was the motor proper, having storage cylinders and gas-engine for propulsion. It is a matter of regret that the short rails upon which this carriage stood were not extended to those laid around the Exhibition for the electric system. An excellent opportunity appears to have been lost for popularizing this form of locomotive, and also for comparing the two systems as to cost and general efficiency. The carriages were about the size of a small railway company omnibus, but much more heavily built—rather more like some of the Berlin tramcars, but smaller, and equally wanting in lightness, grace, and attractiveness. The machinery was not open to inspection at the time of our correspondent's visit; therefore no opinion can be given as to its fitness for the work for which it was designed. Of the carriages, however, it may be said they did not appear to him to be the model type for the future gas car. It is hoped this part of the official report will be full and satisfactory; as it will be looked forward to with probably more interest than that in regard to any other portion of the Exhibition.

## THE ORIGIN OF WAVES OF LIGHT.

At the last Annual Meeting of the German Association of Gas and Water Engineers, Dr. W. WEDDING, of Berlin, read a paper on the above subject. It has since appeared, by the author's permission, in the "Zeitschrift für Beleuchtungswesen." In the following abstract of its contents, results are given in English terms, on the basis of 1 English standard sperm candle being equivalent to 1·14 Hefner units of light.

The sun has for thousands of years been the nucleus of a turmoil of scarcely diminishing intensity. Life and subsistence on the earth are only possible on account of this uninterrupted disturbance on the sun's surface. The energy set free is dispensed to the earth, not by molecular transference, but by oscillations of the ether—a hypothetical material assumed by physicists to pervade all bodies and all space. Its very existence is only demonstrable by certain effects, for the production of which a gas of the highest conceivable tenuity appears necessary. The ether is the medium of radiation by which the sun's activity is propagated abroad through space to us; and were the ether to come to a state of rest, all life on the earth would cease. The ether is not transported, but is merely stirred into an undulatory motion. Each particle is subject to a certain number of oscillations in unit time, and these recur within the same limits of space. For every movement propagated through the ether, there is a length of oscillation, or wave-length, standing in fixed relation to the number of oscillations in a given time. If $\lambda$ = the wave-length, $n$ = the frequency, and $v$ = the velocity of propagation, then this relation is expressed by the equation $n\lambda = v$. Assuming that $v$ is constant at 300,000 kilometres per second, then $n$ may be found so soon as $\lambda$ is known.

All the ether particles need not have the same frequency at one time; but as the velocity is constant, a certain wave-length corresponds to every different frequency. In other words, different radiations may be propagated simultaneously. With a given wave-length and a given frequency, the amplitude of the oscillations may vary; or, more briefly, the intensity of the radiation may vary. In electrical phenomena, Rubens found wave-lengths of 3 centimetres; and the corresponding number of oscillations per second would be about 10,000 millions. When the number of oscillations is about 60,000,000 millions, and the motion of the ether extends to bodies, their molecules begin to vibrate, and the vibration becomes apparent as heat. The electrical resistance of fine wire brought into the course of these rays becomes changed, and the radiation may be measured by the bolometer. The point of juncture of two dissimilar metals if brought in the course of the rays becomes a source of electromotive force. A thermometer placed in the course of the rays rises. The human body is sensible of these rays, which occasion the feeling of heat.

The more frequent the oscillations, the shorter is their wave-length; and with 400,000,000 millions of oscillations per second, our eyes receive the impression of red light. As the number of oscillations rises, there succeed the impressions of orange, yellow, green, blue, and violet light—800,000,000 millions of oscillations giving the last colour. If all the oscillations between these numbers occur at the same time, the impression produced is that of white light, such as sunlight. Oscillations of less frequency than 400,000,000 or more than 800,000,000 millions give no direct impression to the human eye; and all shades of colour lie within that range.

The field in which the lighting expert works is thus restricted. He aims at finding a substitute for sunlight at times and places where that is not available; and since light that differs greatly from it is distressing to the eye, the substitute must resemble sunlight as closely as possible. Petroleum light and candle light are red; electric glow lamps and gas-lights, red to yellow; incandescent gas-lights, green; and electric arc lights, blue—in comparison. Perhaps the flame of pure acetylene most nearly resembles sunlight. The sun, however, dispenses light and heat, both of which are essential to existence. But man often desires more of one or the other than Nature affords at the time; and the problem to be solved in practice is the dissociation of the light and heat rays. In the daytime, when the sun furnishes both, man may require more heat than it gives directly—perhaps for personal comfort, perhaps for engines and machinery. Under other circumstances, he may have a surplus of heat, but needs more light; and he will then endeavour to produce light-rays only.

Much has been done to further this endeavour; but how much yet remains may be judged from the fact that in electric lighting 90 per cent. of the total energy is expended in heat

rays, and in ordinary gas lighting only 1·5 per cent. is given forth in light-rays. The demand for more light progresses with its partial gratification; and, concurrently with the reduction of the heat developed, sources of light have gradually become more powerful. Sunlight is still far from being well imitated artificially, either in colour or in intensity. On a bright day, the sun's light falling vertically on white paper on the earth's surface is equivalent to that of 288,000 candles. Light of this intensity can, indeed, be produced from the electric arc; but the radiation from the small area is so great compared with that from points in the vicinity, that the effect is merely to dazzle.

In daylight, all points are uniformly illuminated; and the natural transition from light to darkness also is easy. Dazzling contrasts are absent, and a harmonious uniformity prevails which artificial lighting has not successfully imitated. The human eye, which is able to distinguish objects by a light of 1-4000th of a candle 39·37 inches distant, is too sensitive, and is particularly offended by the arc lamp. Hence the favour with which the incandescent electric lamp was received. Artificial lights are usually associated with much heat. We may escape the sun's heat by passing into the shade, and yet have the benefit of its light; but if we pass into shade to avoid heat-rays from artificial lights, we are in darkness.

The aim in this branch of technics is, therefore, to obtain for a given expenditure of energy as much light and as little heat as possible. Some figures will indicate what has been accomplished. One candle-hour obtained in various ways requires an expenditure of material or energy which, if turned solely to the production of heat, would give the following amounts :—

| | Kg. Calories. |
|---|---|
| Petroleum-lamp (light measured in horizontal plane) | 36·5 |
| Coal gas— | |
| Bray burner | 75·8 |
| Argand burner | 57·0 |
| Incandescent burner | 11·4 |
| Incandescent spirit-lamp | 12·1 |
| Acetylene | 10·2 |
| Coal gas— | |
| Wenham burner (mean hemispherical lighting value | 21·0 |
| Electric Light— | |
| Incandescent | 3·0 |
| Arc | 0·3 |

Judgment based on these figures must be modified by considerations of the power of the light in each case, and of the actual cost of its production. The unit light in the above cited methods ranges from 15 to 1000 candles. The figures show, however, how great have been the advances in the application of gas to lighting purposes. Taking coal gas at 4s. 6d. per 1000 cubic feet, petroleum at 10·9d. per gallon, and electrical energy at 7·2d. per kilowatt-hour, the following values for the cost of 1000 candle-hours may be found :—

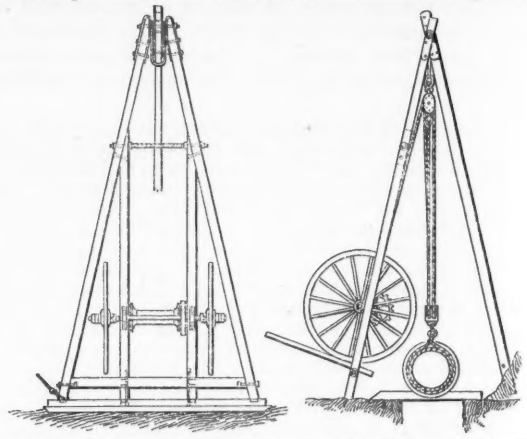
| | os. 10·0d. |
|---|---|
| Petroleum lamp | |
| Coal gas— | |
| Bray burner | 2 5·2 |
| Argand burner | 1 9·9 |
| Wenham burner | 0 8·0 |
| Incandescent system | 0 4·4 |
| Electric light— | |
| Incandescent | 2 1·0 |
| Arc | 0 2·5 |

Each description will evidently find favour under certain circumstances. The gas and electrical industries are inherently opposed to one another; but the rivalry has immensely benefited both.

No impression is conveyed to the human eye by oscillations of the ether exceeding 800,000,000 millions per second. Rays having oscillations of greater frequency are very active chemically, and are at the root of the photographic art. Beyond these actinic rays, in exhausted spaces, we have those known as cathode rays, produced by the aid of electricity. At the opposite end of the scale, we find electrical phenomena accompanying the low-frequency oscillations. The energy applied in Geissler tubes is almost wholly given out as light; hence their efficiency as light-producers is very high indeed. This high efficiency is, however, practically wholly discounted by the unavoidable and very great loss of energy in transmission from its source to the tube. With more thorough exhaustion of the tubes, the bluish-red light ceases, and the rays, though dark, on striking the glass are transformed into light and heat rays, and a lovely green colour is produced. But the whole of the energy is not thus transformed, for some of the invisible rays traverse the glass, and exhibit properties which Röntgen has already made known. Though the wave-length and frequency of these rays are still in doubt, practical application has already been made of them. The revelation of others of still shorter wave-lengths and higher frequency is quite within the range of probabilities; for though the human eye is only sensitive to rays of limited compass, yet with the aid of ingeniously and finely-made instruments, we may extend the limits of our knowledge. The energy brought by oscillations of the ether from the sun to the earth disturbs the equilibrium which would otherwise obtain here; and life consists in a perpetual struggle to restore quiescence. But man strives too keenly to allow Nature to pursue her course undisturbed. He wants more energy than the sun furnishes; and he applies to that stored up many years since in coal and other materials. The energy then derived by radiation from the sun he now uses to secure light in the periods of darkness.

## A PORTABLE DERRICK FOR PIPE LAYING.

The accompanying illustration of a portable derrick is taken from "Engineering News." It has been in use for some years by the American Water-Works Company, as well as by others, for laying pipes, hoisting material from manholes, &c. It is not patented; and as it is exceedingly useful and inexpensive, it has been published for the benefit of contractors generally.



Among its other advantages, it involves less labour in handling than the ordinary tripod; and in transportation it can be moved on its own wheels by simply attaching the top of the derrick to the rear of a waggon. The drawing is so plain that no special description of the working of the derrick is necessary.

"**Uniter**" is the name of a new transparent solution for coating galvanized iron preparatory to its being painted. When the paint is applied—after the solution has been put on—it adheres permanently, and is said not to peel off. The solution may also be used on black sheet iron, bridges, bright ironwork, and other constructional ironwork.

**A Simple Form of Gas-Regulator**, devised by Herr Saarbach, has been described and illustrated in the "Journal of the American Chemical Society." The flow of gas is regulated by the motion of a column of mercury, actuated by the expansion of air confined in a bulb. One form is suitable for use at high temperatures; being provided with a second bulb and enough mercury to furnish a seal sufficient to prevent the escape of the expanded air. The apparatus can be readily cleaned and refilled; and it is stated to be only slightly influenced by the daily changes in the atmospheric pressure.

**A New Elementary Body.**—As the result of his researches on monazite sand, M. Barrière has discovered, according to the "Chemical News," a new elementary body which can be utilized for the production of incandescent gas-light; and he has given to it the name of "Lucium." Its composition is stated to be of such a nature as to allow of its employment without risk of infringing the Welsbach patents. Investigation has shown that while the salts of cerium, lanthanum, and didymium form with sodium sulphate insoluble double salts, lucium does not; nor does it, like thorium and zirconium, form these salts with sulphate of potassium. Spectroscopic examination of lucium reveals the fact that its lines slightly approximate those of erbium; but it differs from the latter in several respects. It seems, therefore, to be a distinct elementary body. Its atomic weight has been calculated at 104.

**The Explosive Properties of Acetylene.**—In connection with the fatality recorded in the "JOURNAL" last week (p. 754), it may be of interest to refer briefly to some experiments carried out by MM. Berthelot and Vieille on the explosive properties of acetylene, as recorded in a recent number of the "Comptes Rendus." The object was to see what precautions, if any, were necessary in the preparation, compression, and storage of acetylene for commercial uses. It has been known for some time that the decomposition of acetylene by a heated wire, by mercury fulminate, or by the electric spark, is not propagated any considerable distance, if the gas is under atmospheric pressure. At pressures of two atmospheres and more, however, the decomposition is complete; the explosive pressure produced rising so rapidly with the initial compression, that the effects produced by detonation of the liquefied gas resemble those of ordinary explosives. According to "L'Electrochimie," the pressure in the receivers containing liquefied acetylene is, at 68° Fahr., 42·8 atmospheres, or 628 lbs. per square inch; and it becomes 68 atmospheres, or 1000 lbs. per square inch at 986°. These pressures are higher if the liquid, at these temperatures, fills the receiver. On account of these high pressures, and as the gas is endothermic, the cylinder containing liquid acetylene must be handled with great care; and the escape of acetylene at the closing cock of the receiver, or at the reducing of pressure, are difficult to avoid. For these reasons the use of liquid acetylene, says our contemporary, should be placed under strict control.

# REGISTER OF PATENTS.

**Coin-Freed Gas-Meter.**—Hollanders, E., Leather, C. J., and Taylor, T., of Southsea. No. 17,621; Sept. 21, 1895.

The arrangement of this "coin-freed controlling apparatus for use with fluid meters" is shown in the engravings. Fig. 1 is a side elevation of a gas-meter fitted with the apparatus. Fig. 2 is a fragment of a front elevation, with a part section. Fig. 3 is a sectional side elevation. Fig. 4 is a fragment of a rear elevation, with a part section.

Fig. 1.

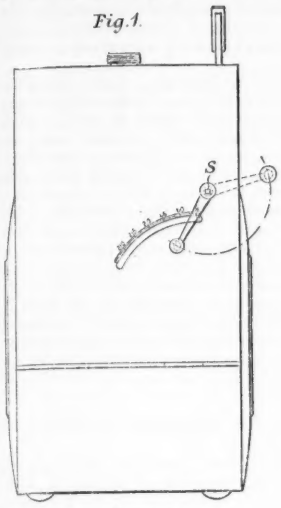



Fig. 3.

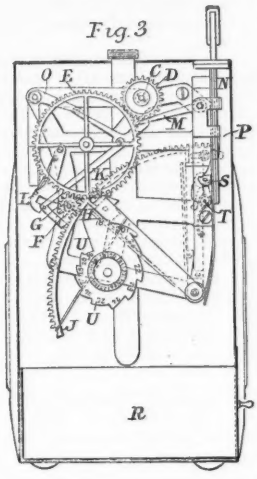



Fig. 2.

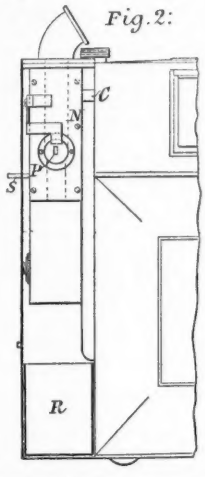
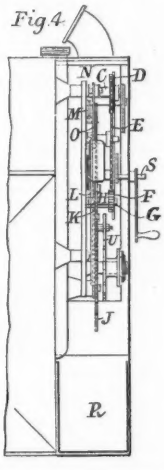



Fig. 4.




The controlling apparatus, enclosed in a box or cover on one side of the meter, is connected with the mechanism, by which the dial-hands of the meter are operated, by means of a shaft C passing through an aperture in the side of the meter, and carrying a toothed wheel D. This latter is connected by a train of wheels E F to a shaft G, mounted on a fixed part of the apparatus, and carrying a single-toothed lantern pinion H, which gears with the teeth of a counterweighted rack J, pivoted so as to raise the rack and cause it to turn on its pivot, and advance one tooth for every revolution of the shaft G. K is a pawl for holding the rack up as it is gathered tooth by tooth, and furnished on one side with two projecting pins. One of these pins engages in a notch in a pivoted detent L, pressed towards the pawl K by a spring. The other pin lies in the path of one arm M of a frame, which is pivoted beside the coin-shoot N, and acts as a bell-crank lever with its other arm lying in front of an aperture in the side of the coin-shoot. The pawl K is further provided with an arm, which lies in the path of a pin on a bent counterweighted lever O, and is firmly secured to a rod passing through an aperture in the side of the meter, and furnished with means whereby it acts as a stop to shut off the gas.

The rack J is provided with a forward prolongation or tooth, which forms part of a plate resting flat against the face of the arm of the rack, and is secured to it by a pin and slot, and held in its forwardly projecting position by a spring fastened to the arm. On the further side of the plate is pivoted a nose, the rear of which rests on a knife-spring, while the front part proper projects forward beyond the rack-arm. The nose can turn slightly on its pivot only in an upward direction against the pressure of the spring (after the manner of a knife blade); so that, if pressure is put on the under edge of the nose, it will be turned on its pivot, and will press back the spring without affecting the plate carrying the projecting tooth; whereas if pressure is put on the sloping front edge, the nose, being (by reason of suitable stops) prevented from turning on its pivot, will push back the plate to which it is pivoted against the pressure of the spring, and will carry it back, together with the tooth forming part of it, within the limits of the pin and slot in the rack-arm.

In the path of the spring tooth is a slot P, situated in the rear side of the coin-shoot N, and communicating with an aperture in the opposite side of the shoot. In front of the aperture the coin Q rests when it has fallen to the bottom of the shoot; and it is there held by the arm of the bell-crank lever arrangement already described. At the extremity of the travel of the rack J, the nose enters the slot P, and (acting direct on the back of the coin) pushes it out from the recess formed by the aperture. The coin then takes a slightly oblique position, and forms a connecting link between the rack and the bell-crank lever arrangement M, which latter is thereby operated, raising the pawl K from the rack, which then falls and releases the coin, which drops away from the arm into a receptacle R beneath.

In fig. 3, the rack is shown in full lines ready to be gathered up tooth by tooth by the lantern pinion H; and in dotted lines, the rack is shown at the forward extremity of its travel—having entered the empty slot P, and become locked in that position.

In the path of the spring nose is a double cam shaft S, journalled on the side of the coin-shoot, and having a stop to prevent it from being rotated beyond fixed limits of about 120°. The shaft projects through the side of the meter cover, and is operated by means of a handle. On a parallel shaft T is a sleeve carrying a catch-hook, which, by means of a spring, is caused normally to bear with its ear against the first cam on the shaft S; while the second cam lies directly in the path of the spring nose on the rack J. The rack-arm also carries a rod, which is caught by the catch-hook; the rod also serving as a stop to limit the fall of the rack under the action of gravity in the following manner: In the path of the rod is a stepped snail or nautilus cam U, which is adjusted so as to allow the rack J to fall to a greater or less degree according to the quantity of fluid to be delivered for the coin inserted in the machine. The cam, and the means for adjusting it, are inside the meter case. The rod, however, projects through an arc-shaped slot in the case, and carries a pointer, which moves over the graduated arc, and indicates the quantity of fluid to be delivered in exchange for the coin and any intermediate quantity remaining undelivered in respect of the coin which has last operated the rack.

**Incandescence Bodies for Illuminating Purposes.**—Wheatley, W. H.; a communication from C. Schmid, of Brussels. No. 18,263; Sept. 30, 1895.

The patentee proposes to impregnate incandescent hoods or mantles (which may be made of any suitable fabric) with the solutions of salts which he specifies; the mantles being afterwards subjected to the heat of a flame in the ordinary manner, so that the fabric is consumed, while the frame or skeleton (consisting chiefly of the oxides of the metals employed) remains, and which, when heated to incandescence, emits a powerful light. The formulæ of three several solutions to which the invention relates, and which are said to give excellent results in practice, are as follows:—

| | | |
|---|---|---|
| 1 | Lanthanum nitrate | 60·00 parts. |
| | Strontium ,, | 10·00 ,, |
| | Silver ,, | 0·25 ,, |
| 2 | Zirconium nitrate | 100·00 parts. |
| | Strontium ,, | 18·00 ,, |
| | Silver ,, | 0.50 ,, |
| 3 | Zirconium nitrate | 100·00 parts. |
| | Calcium ,, | 20·00 ,, |
| | Uranium ,, | 0·50 ,, |

**Manufacture of Coal Gas.**—Thomas, J. T., of Bisham, and Hunt, A. V., of Upper Thames Street, E.C. No. 18,395; Oct. 2, 1895.

The specification of this "invention" (which is not illustrated) states: "In carrying out this invention, we use the tar as produced in the usual manner in the distillation of coal; and this tar we admix in suitable proportion with some cheap small material, preferably of an inert nature—such, for instance, as common house coal ash, flue ash, or dust such as is removed from furnace-flues, when coal dust is used in the furnaces—and subject this mixture to distillation in the retorts, along with the usual coal from which the gas is produced. We have found that, when the coal tar is admixed with the dust or ash in sufficient quantity to produce a mortar or pasty mass, a good result can be obtained; and in carrying out our invention, we find it desirable to treat this mixture at a comparatively low temperature, and that the best results are obtained by putting the mixture into the retorts at or towards the front ends. We have in our experiments used the tarry paste in the retort in the proportion of from about one-twelth part by weight of the tarry paste to eleven parts by weight of the usual coal employed; but the quantity may be reduced or varied. The carbonized mass left after the pasty mass has been burned is easily removable from the retort, and can be utilized as a coke fuel."

**Gas-Engine.**—Lanchester, F. W., of Alvechurch. No. 18,908; Oct. 9, 1895.

This is an invention of certain arrangements whereby the temperature of the walls of the motor cylinder and compression space of gas and oil engines can be kept uniform by the passage of air over the cylinder walls; and at the same time a supply of air at practically uniform temperature is available for vaporizing the oil as required in oil-engines.

Fig. 1 [next page] is a cross section of an engine cylinder with the cooling jacket in position. Fig. 2 is a plan of mechanism for regulating the temperature. Fig. 3 is a side elevation of the air-supplying device.

The motor cylinder A is made of steel tube; and there is forced or shrunk thereon a number of rings B of copper, or other good conductor of heat, leaving sufficient space for the circulation of air between them. The rings may be of sheet metal stampings, fixed in turned grooves in the cylinder, or (as shown) they may be slipped tightly on the turned cylinder. After fixing the rings in position, they may be turned thinner towards the edge, so as to increase the air-spaces between them without appreciably diminishing their efficiency.

Round the rings and cylinder is fixed an outer casing O, having an inlet E and outlet P, both of large area. The air-inlet leads, by a short pipe F, to a casing Q completely enclosing the fly-wheel rim D. On this rim is fixed a number of vanes C; thus making it serve the additional purpose of a centrifugal fan, and causing a steady current of air to pass between the rings and round the cylinder wall. On the outlet of the casing is a rotating damper G, regulated automatically in the following manner: A compound shaft H is provided, consisting of

an outside tube and a central core fitting it easily; the tube and core being of metals having different coefficients of expansion. The core and tube are rigidly secured to each other at the end R; but at the end T, the tube carries two fixed collars L and a loose sleeve M, between which a pair of loose bevel wheels S revolve. The end T of the core is, however, rigidly secured to the collar M, preferably through slots in the outer tubing and by collars. The shaft H is in the path of the outlet P; and it is driven by a pair of screw gear-wheels (such as

Fig. 2.

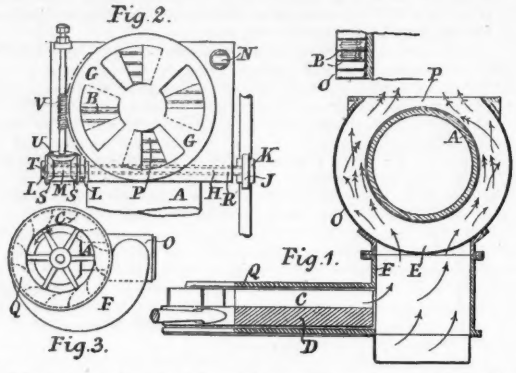



Fig. 3.




Fig. 1.




J K) from the engine. The bevel wheels S gear into a third wheel U, keyed on a small spindle carrying the worm V, operating on worm teeth formed on the edge of the damper G. As long as the outgoing air is at the desired temperature, both the core and tube of the shaft H are of such length that both bevel wheels S ride loosely, and consequently the damper is not operated. When, however, any deviation above or below this temperature takes place, a corresponding difference of expansion occurs between the core and the tube, and causes either one or the other of the wheels S to be gripped firmly between the sleeve M and its collar L. This operates the damper G to increase or diminish the quantity of air passing, and thereby restore its temperature to that desired.

A special advantage of the cooling device illustrated in fig. 1, is found on the establishment of a centrifugal convection current. The air in traversing the jacket becomes heated in the immediate proximity of the hot cylinder surface; and being of less density than the cooler air (owing to the curvature of its path), a centrifugal convection current is established. This action is shown diagrammatically in fig. 1, where the double-headed arrows indicate the hot currents and the single the colder currents.

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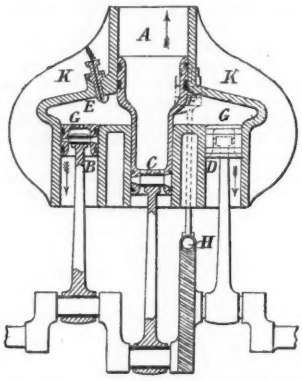
**Motors Worked by Explosive Mixtures.**—Dion, A. de, and Bouton, C., of Puteaux, France. No. 22,402; Nov. 23, 1895.

This invention, relating to internal combustion engines, has for its object "an engine having three cylinders and three cranks on the same crank-shaft, and so constructed and arranged that the moving parts are balanced and the vibration due to the momentum of such parts is reduced to a minimum." The cylinders communicate with each other by a combustion chamber common to all of them; so that only one igniting-device and one valve-mechanism are required.




In the illustration, showing a longitudinal central section of the engine, A B D are the three cylinders communicating with a combustion chamber G, common to all the cylinders, and which is made very strong by webs K to withstand the internal pressure due to the explosions. The cross sectional area of the cylinder A is three times that of either of the cylinders B or D, which are of equal size; and the axis of A is midway between the axes of the cylinders B D. The piston of A is constructed with a trunk C, having the same diameter as the cylinders B D, and working in the cylindrical guide shown. The connecting-rods of the small cylinders B D are coupled to cranks arranged on the same centre; while the connecting-rod of the large cylinder is coupled to an intermediate crank arranged on the opposite centre. All the cranks have the same throw. The weight of the large piston is equal to the combined weights of the smaller pistons. This construction and arrangement of cranks is said to ensure "a perfect running balance both as regards momentum of the reciprocating parts and couples acting on the crank-shaft."

The explosion of the gases is effected by an electric igniter E, or other suitable device. The distribution of the explosive mixture is effected in any suitable manner—for example, by means of valves F actuated by cams or eccentrics driven from the crank-shaft by helicoidal or other gearing H.

**Burner and Means for Supporting Incandescent Gas Mantles.**—Brouwer, J. de, of Bruges, Belgium. No. 23,768; Dec. 11, 1895.

This invention was described and illustrated in the "JOURNAL" for March 17 (p. 566).

The burner referred to consists of a metal cylinder, terminated at its upper part by a cap of refractory material perforated with numerous holes of small diameter (2 to 3 millimetres). Under the cap, one or more metal or wire screens may be fitted. The lower open end of the cylinder adapts itself to the top of the blowpipe or bunsen burner with forced air supply, forming the subject of a prior patent, No. 20,697, of 1895 (*ante*, p. 695), in connection with its employment to burners for incandescent mineral substances. A metal ring sliding on the cylinder of the burner can be fixed at any desired height by a set screw or other device.

The mantle (of mineral substances of the kind employed in the Auer incandescent burners) is enclosed in an envelope or basket of platinum wire; the mantle and its supporting envelope being in contact with each other. In order to form the mantle, the patentee takes an envelope or basket of platinum wire, of size proportioned to that of the mantle, which can by experience be ascertained for each particular case. The mantle, before it is calcined, is suspended by its upper part in the centre of the basket. It is then calcined in the usual way; care being taken to keep the base of the mantle well open. When this first operation is complete, the mantle, with its basket, is placed over a burner similar to the one above described, but with the ring removed; and the flame is kept well in the centre of the mantle, which is lowered into the flame, and then gradually raised—the strength of the current being increased at the same time. The high temperature of the flame and the strength of the current operate together on the incandescent substances in fusion and expand the mantle, so that its walls adapt themselves to the basket, taking its shape.

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**Obtaining Hydrogen and Carburetted Hydrogen.**—Green, J., of Wolverhampton. No. 13,510; July 13, 1895.

The method by which, according to this invention, hydrogen is obtained from steam, consists in burning steam with hydrogen gas, with carburetted hydrogen or other hydrogen compound, or with carbon monoxide. If it is desired to produce carburetted hydrogen, hydrocarbon is supplied with the steam, and is burnt therewith and with hydrogen or a compound thereof, or carbon monoxide, which is separately supplied. Or the hydrocarbon, or other substance to cause the desired combination with the hydrogen of the steam, may be brought in in association with the hydrogen or combination thereof, or carbon monoxide, which would be used for burning with the steam if it were desired to obtain simply hydrogen gas.

The apparatus employed comprises a chamber having an outlet-pipe from the top in communication with a gasholder. The steam and gas, which are to be burnt together, are conveyed into the chamber, and burnt within it; and the resulting hydrogen, together with the hydrogen brought into the chamber not in combination in the steam, or the hydrocarbon, or carbon monoxide, in lieu thereof, passes out through the pipe from the top of the chamber, and is collected within the holder. If it is desired to obtain hydrogen in combination—such, for instance, as carburetted hydrogen—the carbon (in the form of a hydrocarbon), or other substance to cause the desired combination with the hydrogen of the steam, may be brought into the chamber, either directly in association with the steam or in association with the gas to be burnt with the steam.

The steam and gas each pass through a considerable length of tubing coiled within the chamber; and both are thus heated (and the steam dried or superheated) on their passage to the point at which they are burnt in combination. The initial heat of the chamber is got up by first burning the gas only; air to support combustion being supplied through an opening in the wall of the chamber, and the products of combustion passing off into the atmosphere through an opening at the top of the chamber. While the heat is being raised, communication between the chamber and gasholder is closed. When the interior of the chamber has become thoroughly heated, the steam is turned on; the outlet to the atmosphere is closed; and communication is opened between the chamber and the gasholder. The inlet opening to the chamber should be closed when the steam is turned on.

The chamber may be supplied with iron turnings or filings, or be filled (or partially so) with other material.

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**Preparing Incandescence Bodies.**—Eiffe, R. J.; a communication from F. Meyer and Co., of Berlin. No. 15,500; July 13, 1896.

The patentee says that his researches have demonstrated the following principle, on which the luminosity of incandescent light depends: The oxides of certain elements are capable at high temperatures of taking up oxygen and of yielding the same again; and thus, in the presence of reducing gases, or the like, of converting themselves into lower oxides, and on the subsequent access of oxygen again absorbing the same. All these bodies may be designated by the technical term "oxygen-conveyors." For instance, copper oxide may be reduced, at about 800° C. by means of coal gas, even to metallic copper; oxide of chromium may be reduced to a lower oxide; and so on. On the other hand, metallic copper, chromium suboxide, and so forth, if heated at 800° C. in the air, will again absorb oxygen, and be reconverted into normal oxide of copper, and of chromium, and so forth. If small quantities of oxides of oxygen-conveying bodies in a state of extremely fine subdivision be distributed throughout larger quantities of refractory (that is to say, non-oxygen-conveying) oxides, and the whole be exposed to the outer surface of a non-luminous flame, the reactions described take place, and an intense light is emitted—a very intense combustion is caused, together with a considerable increase in temperature.

As the result of his own experiments, the patentee claims to have discovered that the combination of his invention, together with the combination set forth below, of zirconia and calcium oxide, produces "an excellent compound of very good power of resistance and hardness;" and he feels no doubt that further experiments may prove that from the elements—specified by other inventors, or from other bodies—such, for instance, as beryllium—practicable combinations may

eventually be formed. But these, as far as he is aware, are not discovered up to the present. As conveyors of oxygen, he has investigated all the elements used by previous patentees, and many other substances—such, for instance, as nickel, iron, and so forth—as well; but he has found that it was not possible to obtain thereby a perfectly satisfactory intense white light. He has, however, by further experiment, discovered bodies by means of which the emission of light is very greatly increased, when accurately determined quantities of oxides are mixed together, and which appear to mutually assist each other in their properties. For instance, a mixture of rhodium and manganese evolves an almost snow-white light; whereas the former when used alone gives a reddish, and the latter a yellowish light. In the same way, palladium with manganese gives a more or less satisfactory effect. The best combination for this purpose known to the patentee consists of a mixture of rhodium and ruthenium with vanadium, approximately in the following percentage proportions: Oxide of calcium, 27·50; oxide of zirconium, 72·30; oxide of vanadium, 0·10; oxide of ruthenium, 0·05; oxide of rhodium, 0·05. A solution of the nitrates or other suitable soluble salts of these bodies is prepared corresponding to the above formulæ; and the mantles are saturated therewith, and prepared for use in the usual manner.

**Starting Gas Motor Engines with Twin Cylinders.**—Abel, C. D.; a communication from the Gasmotoren Fabrik Deutz, of Koëln-Deutz, Germany. No. 18,294; Aug. 18, 1896.

In patent No. 12,003 of 1896 was described an arrangement for starting gas-engines, wherein (after having brought the piston into a certain position in the cylinder) an explosive charge is forced in, while at the same time the piston is prevented, by a suitable device, from being forced forward thereby; the device being, however, made to yield to the greater force produced by the explosion of the charge which effected the starting of the engine.

According to the present invention, this mode of starting is applied in a modified manner to four-stroke-cycle gas-engines with twin cylinders, either placed side by side (the cranks of which stand at an angle of 180° to each other) or opposite each other, with the pistons connected to the same crank. For this purpose, the cranks are first brought into a position at about right angles to the cylinder axis; so that the one piston stands at about the middle of its working stroke while the other is at about the middle of its compressing stroke. Explosive mixture is then supplied by a hand-pump simultaneously into both cylinders, so that the pressures produced on the one side of each piston being equal, but acting in opposite directions on their cranks, no motion of the latter, and consequently of the pistons, can take place during such compression. When a charge of the requisite degree of compression has thus been introduced into each cylinder, that of the first-named cylinder is ignited, and imparts rotary motion to the crank-shaft, so as to effect a further compression of the charge in the second cylinder, which is also ignited as soon as the dead-centre has been passed.

## APPLICATIONS FOR LETTERS PATENT.

22,419.—Settle, T., and Berry, C., "Indicating apparatus for gas-holders and other purposes." Oct. 9.

22,457.—Fitzpatrick, H. D., "Incandescent gas-burners." A communication from the Actien-Gesellschaft für Fabrikation von Broncewaaren und Zinkguss vorm. J. C. Spinn and Sohn. Oct. 10.

22,480.—Urquhart, R. J., and Kros, G., "Production of illuminating and heating gas." Oct. 10.

22,526.—FitzGibbon, L. T., "Production of acetylene gas." Oct. 10.

22,549.—Darby, J. H., "Improvements in the manufacture of gas with recovery of bye-products." Oct. 10.

22,561.—Wright, W., "Gas switch or automatic device for intermittent lighting." Oct. 12.

22,567.—Daniel, G. A., "Gas reversing and other valves." Oct. 12.

22,570.—Akeroyd, H., "Mantle or veil for incandescent gas-lights." Oct. 12.

22,608.—Breeden, J., & Co., Ltd., and Smith, I., "Taps for gas-burners." Oct. 12.

22,628.—Morton-Brown E. A., and Maundrell, F., "Production and storage of acetylene gas." Oct. 12.

22,646.—Smith, A. G., "Acetylene gas generator, purifier, and holder." Oct. 13.

22,647.—Smith, A. J. and A. G., "Adapting acetylene gas for use on cycles, carriages, or other vehicles." Oct. 13.

22,698.—Banner, F. S., "Gas, petroleum, and like engines." Oct. 13.

22,703.—Short, S. H., "Improvements relating to the generation of gas and electricity and to apparatus therefor, and the application thereof to motive power purposes." Oct. 13.

22,705.—Brouardel, E. P., "Improvements in street and other lamps for lighting." Oct. 13.

22,730.—Ewen, J. H. L., "Gas and oil engines." Oct 13.

22,741.—Boult, A. J., "Production and treatment of acetylene gas and apparatus connected therewith." A communication from G. Zambaldi. Oct. 13.

22,782.—Sylva, P., "Apparatus for producing acetylene." Oct. 14.

22,787.—Schemidt, A., and Kaufman, O., "Production of acetylene gas and apparatus therefor." Oct. 14.

22,812.—Martin, E., and Tournier, A., "Incandescent gas-burner." Oct. 14.

22,828.—Crawley, C. W. S., Soames, A., and Drysdale, C. V., "Method of obtaining a continuous supply of gas or vapour under pressure." Oct. 14.

22,887.—Stevenson, G. E., "Improvements in the construction of gas-retort settings and regenerator furnaces for the same." Oct. 15.

22,919.—Moran, K. M., "Gas-burners." Oct. 15.

22,935.—Lanchester, F. W., "Gas and oil motor engines." Oct. 15.

22,956.—Heal, J. B. and S. H., "Installation of acetylene gas and fittings." Oct. 16.

23,019.—Henning, F. S., Pigott, W., and Strain, H., jun., "Water tower." Oct. 16.

23,047.—Sharp, J., "Fluid meters, motors, and pumps." Oct. 17.

23,110.—Tangye, J. H., and Johnson, W., jun., "Gas and oil or petroleum engine." Oct. 17.

# CORRESPONDENCE.

[*We are not responsible for the opinions expressed by correspondents.*]

### The Permanency of Illuminating Gas.

Sir,—If you can find room in your columns for another letter in reply to Mr. Young, I hope that, for the present, I need not further trouble him and your readers upon the subject of naphthalene.

As regards the phenomena at the Old Kent Road works, I endeavoured to prove that, during a period of six months, the gas passing through the station meters had been unsaturated. I need not recapitulate further than to say that the points sought to be established were—

1.—That if the gas entering the purifiers was saturated with naphthalene, it was nevertheless unsaturated when it left the meters in consequence of rise in temperature and reduction of pressure.

2.—That such unsaturated gas sometimes deposited crystals and sometimes absorbed them.

3.—That the varying factor in the case was moisture, which stood to the deposited crystals in the relation of cause to effect.

In considering the consequences of the great rise in temperature during purification, it was evident to me that a larger volume of aqueous vapour could remain in diffusion in the gas; and it was also apparent that water was present in abundance to saturate it. But to my mind it was equally clear that, though a larger volume of naphthalene could also be taken up in diffusion, there was no available source from which such vapour could be derived.

I had been informed that during the six months the temperatures of the gas at the meter outlets had not fallen back to the temperatures obtaining at the inlets of the purifiers, and had, in fact, averaged four degrees higher. I was convinced, therefore, other circumstances being as detailed, that the gas at the meter outlets had never been saturated during the same period, whether the new charges in the oxide purifiers had raised the temperatures or reduced them. I saw that if the new charges of oxide had raised the temperatures higher than they had been before the changes, the absorption of the previously deposited crystals would be accounted for. But this was shown to be improbable; and the point of great importance insisted upon was that the crystals had previously been deposited by an unsaturated gas.

The gist of Mr. Young's reply seems to me to lie, not so much in his highly scientific enunciation of the influence upon napthalene deposits of the water in station meters and gasholder tanks, and the effects of the slowly-changing temperatures of buried mains and service-pipes, as in the manner in which he proceeds to confute my argument by affirming that there does exist any source from which sufficient naphthalene vapour can be derived to "highly charge"—he does not say to "saturate"—the gas, even at the high temperatures obtaining in the lime purifiers.

Mr. Young will, I hope, pardon my joining issue with him once more on this question of finely-divided naphthalene. Having again looked carefully through his paper and his letter in the "Journal" for Sept. 1, I am surprised to find that in his last letter he claims for the powder an importance far greater than he apparently assigned to it at first. In the paper he told us that (1) from sudden cooling of the products of carbonization there is produced a gas holding liquid hydrocarbons in mechanical suspension and in an extremely fine state of division; and (2) that, from certain experiments in connection with the manufacture of pneumatic gas, he was of opinion that the addition of hydrocarbon vapour to a saturated coal gas would lead at higher temperatures to the naphthalene being taken up in a diffused condition, again to be deposited as solid naphthalene on the temperature falling in an extremely fine state of division. Both of these effects were therefore attributed to abnormal causes—viz., the finely-divided mist or fog of liquid hydrocarbons, to sudden cooling; and the finely-divided solid naphthalene, to the addition of vapour to a gas saturated with naphthalene. In his last letter, dated the 2nd inst., however, Mr. Young says that the naphthalene powder is a normal product of modern processes of condensation. The gas, he states, is left "at the terminal of the condenser not only saturated with naphthalene, but also holding in mechanical suspension condensed hydrocarbons, mostly naphthalene, in an extremely fine state of division." He adds that these suspended matters are not easily removed; that they remain in considerable quantities in the gas after passing through the washing and scrubbing apparatus; and that at the outlet of the latter their presence is at once made evident on passing a ray of sunlight through the gas.

Certainly, if the naphthalene powder gets as far as the hot lime purifiers, it will be vaporized; and if a large quantity is present, the gas may be highly charged, even at the highest temperatures, in which case the Old Kent Road phenomena may be explainable from the standpoint of saturation. But sudden cooling in the condensers is not modern practice; while enrichment during condensation is in constant operation, so far as I know, in two works only—one being Rotherhithe. Such a statement as the above does, therefore, seem to me somewhat sweeping. Are we to conclude that coal gas cannot be cooled in the condensing plant without the production of finely-divided naphthalene in large quantity, which the earlier removal of the tar enables the gas to retain in mechanical suspension? If so, it would appear probable that the powder would attend condensation always and everywhere. But this is not Mr. Young's teaching, which again on this point seems to me not quite explicit. He speaks of naphthalene in mechanical suspension in the gas being again taken up in diffusion as vapour in the gasholder. Evidently, then, it has reappeared as powder after having been vaporized in the purifiers. But thenceforward its history does not seem to repeat itself; for Mr. Young plainly says that, having been taken up in diffusion in the gasholder, it will be retained as vapour until it meets with the colder surface of some exposed part of the mains or services, when it will be precipitated in the crystalline form. This seems to me to be a case of sudden cooling' and it is not apparent why the vapour should condense here to crystals and there to powder.

I think the fact which has been so clearly brought out by Mr. Young—*i.e.*, that powder in suspension will be vaporized in the active lime purifiers up to the saturation-point of the gas at the highest

temperature, throws grave doubt upon his explanation of the results of enrichment during condensation at these works, though it meets, in part, my objection that the powder would all be removed by the friction of the purifiers. For Mr. Young states that the addition of hot vapour to the gas at the terminal of the condensing plant will intensify the normal conditions, which I understand to be three.

1.—The gas is saturated at the outlet of the condensers with the vapour of naphthalene.

2.—The gas also carries in mechanical suspension condensed hydrocarbons, mostly naphthalene, in an extremely fine state of division, of which a large quantity is carried forward through the washers and scrubbers into the purifiers.

3.—This considerable quantity entering the hot lime purifiers is vaporized, and highly charges the gas, even at the highest temperatures.

These are the normal conditions, which are intensified by the addition of vapour during condensation; and I gather that one effect of the added vapour is to throw out more naphthalene as a finely-divided solid in suspension—thus increasing the quantity entering the purifiers. But does it follow that the quantity of naphthalene in the gas leaving the purifiers is also increased? Mr. Young says the mechanically suspended naphthalene is in part filtered out by the purifying material, and in part vaporized. If there is enough present, the gas will evidently be saturated at the highest temperature attained, But will Mr. Young go so far as to tell us that, under usual conditions, there is sufficient powder to leave a residue in suspension after running the gauntlet of the filtering effect upon it of the purifying material and the vaporization resulting from the high temperature? If not, I cannot see that the additional quantity produced in the condensers by enrichment will get to the photometer-room; and therefore, to my mind, the Rotherhithe results are not satisfactorily explained by the powder theory.

I do not think Mr. Young's explanation of the thicker deposits at bends and tees is adequate, because I should suppose that, as soon as a thin layer of crystals had been deposited, it would act as a lagging, and thereafter delay cooling at such spots; but the crystals evidently continue to be deposited there in greater quantity than upon the surfaces of the straight pipes. I have recently verbally asked about a dozen engineers if they are familiar with naphthalene as a powder. The replies have been in the negative; but one or two have spoken of granular deposits, which, however, are thought to be due to the breaking down of crystals—a condition of things which I suggest may very possibly be due to partial and arrested sublimation, or the fall of masses of crystals (say) in gasholder inlets.

Mr. Young cannot see why, if aqueous vapour is precipitated as a mist or fog, naphthalene vapour should not be similarly condensed. To tell the truth, neither can I; but if the powder exists in the large quantities stated, and is likely to fall to the bottom of mains, and to be washed into the drip-traps, it must be visible in the mass, and ought, I think, to be found in the works and in the area of supply. I should like, therefore, to have ocular evidence of its existence. I have the greatest faith in Mr. Young's experiments; but if the powder is so abundantly produced in every gas-works, it is singular that the fact is apparently unfamiliar to many gas engineers. Mr. Young says that its presence at the outlet of the scrubber may be made evident upon passing through the gas a ray of sunlight. I have tried some experiments, with the following results:—

1.—In diffused sunlight, the gas at the scrubber outlet is invisible when allowed to escape into the air between the eye and the sun.

2.—In a hut, erected over the gas-main, to which light was admitted through a small orifice, the path of the ray was traceable by the lighting up of the dust particles which lay in its course; and a somewhat elliptical patch of light was thrown upon a white surface. When the stream of gas was directed against the path of the beam at right angles, an effect which I can only describe as a difference of hue in the beam was at once apparent. But the illuminated spot on the white surface was unchanged in shape, size, outline, and brightness. The effect when the stream was directed diagonally against the beam was identically the same. When the current was thrown towards the circular orifice along the path of the beam, the change of hue was more pronounced, but the bright spot was still unchanged. I will neither affirm nor deny, but will say I think, there may have been one other effect: Perhaps the dust particles originally visible in the track of the beam were slightly increased in quantity by the issuing gas.

3.—In looking through the orifice into the diffused sunlight outside, it was possible to see floating in the atmosphere very minute bright particles; and when (externally to the orifice) a stream of gas was directed across the field of view, these minute bright particles appeared to be slightly more numerous.

Whether these observations were made under conditions of which Mr. Young would approve, and whether the observed effects were such as he would expect, I do not know; but, in any case, such tests are only qualitative, and scarcely seem to me to warrant the quantitative conclusion that the gas carries sufficient finely-divided naphthalene to "highly charge" the gas at the high temperatures obtaining in the lime purifiers.

Here, Sir, I leave the matter for the present, unless courtesy compels me to answer any direct question by Mr. Young. I hope, as opportunity offers, to continue my experiments; and if anything of special interest should result, it may be that I shall ask for further space in your columns. In taking leave of the subject, I have to express my sense of the patient and courteous manner in which Mr. Young has dealt with my heterodox opinions, and to assure him that, if upon some points I am still unconvinced, I have nevertheless the highest respect for his authority, and therefore cannot but keep an open mind in regard to the questions upon which I have unfortunately found myself in disagreement with him. It may interest some of your readers to hear that the published results of my experiments on a working scale have been confirmed at the Mitcham Gas-Works. Mr. Green informs me that for some months he has been enriching his gas during condensation, and has found that half a gallon of hydrocarbon liquid per ton of coal will raise the illuminating power one candle per 5 cubic feet. I thank Mr. Green for permitting me to make this statement.

*Rotherhithe Gas-Works, Oct. 17, 1896.* A. F. Browne.

## The Self-Enrichment of Coal Gas.

Sir,—I am sorry to trouble you again in this matter; but as Mr. Martin's letter of the 12th inst. practically demands some passing notice, the responsibility for so doing must rest upon shoulders other than mine. I am loth to believe that anyone who has carefully perused the paper and patent specification alluded to could, with any degree of fairness, arrive at such conclusions as those laid down by that gentleman.

With regard to Mr. Martin's own experiments, I do not feel called upon to offer any remark; and having in my last letter disposed of the question of appropriation originally raised, one point only remains—viz., the fundamental difference between returning holder gas, and the method patented by Mr. Broadhead and myself. The Ormskirk system is evidently very similar to the idea originally entertained by myself. As quoted by Mr. Martin, "the idea was to return thoroughly purified gas," &c. But it must be borne in mind that this was at the outset of the experiments, and is likewise found almost at the commencement of my paper. As one reads on, he will find the various results described, and their probable causes sought for; one thought being "that possibly the original idea of returning thoroughly purified gas had not been sufficiently adhered to;" and—quoting again—"with a view of once and for all setting this matter at rest, gas was returned from the station meter inlet" (holder gas to all intents and purposes), "but here as elsewhere the unexpected happened, for instead of steadying the fluctuating results previously obtained, they were lost entirely, *and replaced by a slight actual decrease in illuminating power.*" Arrangements were then made whereby gas returned from every available point could be tried; and "commencing at the *station meter inlet*, and systematically working backwards towards the exhauster, gradually improving results were obtained, until, when returning gas in the proportion of about 8 per cent. of the make from the second scrubber inlet, results almost identical with those in the first instance were obtained." The foregoing, by-the-way, is from the Low Moor experiments. Before commencing the Grantham tests, it was deemed advisable "to corroborate or otherwise *the deteriorating effects of returning thoroughly purified gas.* Briefly stated, *the illuminating power of the gas was found to fall slightly under these conditions.*"

To turn now to the patent specification, respecting the kind of gas we do use, and to quote from the same, we distinctly state that: "In enriching gas according to our invention, we convey a portion of the partly purified gas—10 per cent. more or less, according to requirements—from a point generally found between the exhausters and purifiers (as usually placed); that point varying with local conditions. The place required is where the gas contains the lighter hydrocarbon or oil vapours, after the extraction of the tar; or, in other words, *where the gas contains the minimum of tar vapours with the maximum of oil vapours.*" How to express more explicitly the difference between thoroughly purified gas and that at the stage of manufacture above mentioned, I am at a loss to know; and I consider myself justified in describing it as a radical difference, for it is not simply a question of diluting the newly-made foul gas, but of returning the lighter of the oil vapours as such, that those of a slightly heavier nature may become to some extent saturated, and by such means be assisted forward, and take a permanent place in the composition of the finished gas. Respecting the original patent protection, Mr. Martin may easily satisfy himself, both as to its existence and contents, if he cares to take the necessary steps to secure a copy. The specification bears date June 14, 1895, No. 11,577.

Allow me, in conclusion, to state that since reading my paper at Retford, we have sent out gas at Grantham as high as 19-candle power, produced from ordinary South Yorkshire and a small proportion of Durham partly screened coal combined, and without the aid of any other form of enrichment than that under discussion.

*Grantham, Oct. 23, 1896.* R. G. Shadbolt.

## The Cost of Heating Rooms by Gas.

Sir,—Some curious statements are going the round of the papers; and they are so misleading in every way that it will be well to recall the result of a series of elaborate trials made continuously by myself for a period of twelve months, under exact conditions. The full report of the result of these experiments was published in the "Brewers' Journal" for April 15, 1895, as the experiments were undertaken specially to determine the cost of heating brewers' bottling and conditioning stores; and the figures obtained are well worth preserving, as a basis for calculation for all rooms kept at a regular temperature night and day.* It was found that the heat required had not the slightest relation to the cubical capacity of the room; this depended entirely on the area of the wall surface and on the ventilation. Several rooms were tested; and it was found that, of the total heat evolved, from 75 to 87½ per cent. was absorbed by the walls and ceiling, where the ventilation was limited. Only 12½ per cent. of the total heat was used in warming the air; and the rule was discovered that, for every 1600 square feet of wall surface, excluding the ceiling, a gas consumption of 1 cubic foot per hour *maintained* a rise of 1° Fahr. when the air in the room was changed every hour. If the air is entirely renewed every twenty minutes, 37½ per cent., or a little more than one-third, was used in warming this air; and the gas consumption for the same result rose to 1¾ cubic feet per hour for every 1° rise *maintained*.

Of course, if the temperature of a room has to be raised quickly, the proportion of heat absorbed by the walls increases enormously, as does the gas consumption; but the fact remains that, whatever the heat required to warm the walls, and lost in this way, the heating of the air required only 1 cubic foot per hour for every 1600 square feet of wall surface, for every 3° Fahr. rise of temperature, when the whole of the air in the room was entirely renewed every twenty minutes—a fair average for ordinary living rooms. When a room has to be warmed quickly—say, 20° Fahr.—the proportion of gas used in warming the air becomes infinitesimal, as, whatever the heat absorbed by the walls, that taken up by the air, and retained by it, never varies.

*Warrington, Oct. 23, 1896.* Thos. Fletcher, F.C.S.

* See "Journal," Vol. LXV., p. 848.

# MISCELLANEOUS NEWS.

## THE LIVERPOOL CORPORATION AND THE GAS COMPANY.

### The Directors' Reply to the Lighting Committee.

The report of the Lighting Committee of the Liverpool Corporation on the gas supply of the city (an epitome of which appeared in the "JOURNAL" for June 9 last*) has received the consideration of the Directors of the Gas Company; and their "observations" upon the questions raised are as follows:—

The Board have carefully considered the report presented to the City Council by the Lighting Committee, upon which, in compliance with the invitation of that Committee, they are now prepared to express their opinion. In the first place, the Directors consider the report a complete vindication from the charges that have been publicly brought against them; and though they do not feel called upon to reply to the various remarks made by the Gas Engineer of the Birmingham Corporation, they would call attention to the fact that the two main questions submitted to him by the Lighting Committee —viz, as to the quality of the Liverpool gas and the method of its manufacture—were satisfactorily answered so far as the Liverpool Gas Company is concerned. The suggestions made by him as to the manufacture of gas in Liverpool had been in the main already acted upon. At the same time, the Directors would point out that, having the services of an Engineer who ranks probably as high as any man in his profession in the United Kingdom, and whose long experience better fits him to pronounce an opinion in reference to the manufacture of the special quality of gas required under statutory regulation in Liverpool, they must be guided by his judgment in the manufacturing department of the Company. The conclusions of the Lighting Committee appear to be summed up in four suggestions, to which the Directors will now address themselves.

(1) It is suggested that the Corporation should have the power of nominating two or more of its members to seats on the Gas Board. The Corporation, however, has purchased the Electric Supply Company's undertaking, and become a competitor to the Gas Company for supplying light to the public; and it is an unheard-of thing that rival traders should be granted the power of appointing Directors upon the Board of a Company with which they are competing. The Directors are very firmly opposed to this suggestion.

(2) It is suggested that increased powers should be conferred upon the Auditor. The Directors are at a loss to understand what further powers could be given to him, *quâ* Auditor. He has full powers to inspect all the books, papers, contracts, whether for purchase or sale, and also the minutes of the Board of Directors; and of these powers he avails himself to the full, whilst every information and explanation that he may require is promptly afforded him. If, however, the suggestion implies that powers beyond those of an auditor should be conferred upon him, the Directors would feel compelled to offer to it their decided opposition. Such powers are already possessed by the Recorder, who appoints an accountant to report on the actual state and condition of the Company, and "may examine any witnesses upon oath touching the truth of the said accounts and the matters therein referred to; and if it thereupon appear to the said Recorder that the profits of the undertakers for the preceding year have exceeded the prescribed rate, the undertakers shall, in case the whole of the reserve fund has been and then remains invested as aforesaid, and in case dividends to the amount hereinbefore limited have been paid, make such a rateable reduction in the rate for gas to be furnished by them as in the judgment of the said Recorder shall be proper." The Directors can see no reason for exceptional legislation on these points as affecting the Liverpool Gas Company.

(3) It is suggested that further capital outlay for the extension of works "should be provided in greater proportion than heretofore by debentures instead of shares." The Company's present borrowing powers are clearly defined under existing Acts, and cannot be altered; and as the Gas Company is not likely to be applying to Parliament for some time to come for further monetary powers, a discussion upon the subject could serve no practical purpose at the present moment, and will be better dealt with when the time for doing so arrives.

(4) The Directors note that the Committee does not press for any alteration of the candle power at the present time; and therefore no comment is necessary upon this subject. It would appear, however, that the Committee consider "that improvements in the manufacture which would cheapen the cost of production are possible is evident; and the Directors of the Gas Company should be urged to take the necessary action." This opens up a very wide subject; but the Directors can assure the Committee that they are taking steady and continuous action in the direction suggested. The difficulty of doing this in most of the Company's works is very great; but no effort is spared, as circumstances arise, to introduce all the newest labour-saving appliances, and to bring up their works to the highest state of economic efficiency. Mr. Hunt in his report says: "At four of the works, these can hardly be introduced without extensive reconstruction, in preference to which an opportunity is afforded by the Garston site, of which the Company may be expected to avail themselves, of erecting works upon the most modern lines, to take the place, in part at least, of some of the old manufacturing plant." The Directors would point out that either of these courses would involve a very large outlay of money; and whether reconstruction of old works, or replacement of old by new, were adopted, the expenditure would be a charge upon revenue, and would necessarily involve, even though spread over several years, an addition to the present price of gas which would hardly be satisfactory to the general body of consumers. The Directors are most anxious to provide for consumers the cheapest article they can, consistently with the quality required, and will continue to do everything in their power to discharge faithfully the obligations laid upon them.

* The discussion in the Council on the Committee's report, and the text of the report by Mr. Charles Hunt on his investigations into the existing methods of the Company's working, have been published in the current volume of the "JOURNAL" (see *ante*, pp. 29, 425).

The Lighting Committee on receiving the above "observations" appointed a Sub-Committee to consider them; and their opinions are set forth in the following report:—

Your Sub-Committee have considered the observations of the Directors of the Liverpool United Gaslight Company, and would recommend that the Town Clerk be instructed to reply to the Gas Company acknowledging the courteous tone of their memorandum in reply to the report of the Committee, and its accompanying documents, but expressing disappointment that some of the points raised in these have not apparently engaged the attention of the Directors of the Company.

Your Sub-Committee consider that it would have been of much public interest, and aided them in coming to a right conclusion, if the Directors would give to the Council the benefit of their knowledge and experience as to the advantages or otherwise in respect to the use of oil, either as an enricher to coal gas or for use as an ordinary gas. The opinion of the Gas Company would also be valuable as to whether, and to what extent, the reduction of the statutory candle power to 18 or even to 16 candle power would lessen the cost of production, and how far it would affect the consumer, both from an economical point of view and as an illuminant.

From the concluding observations of the reply of the Gas Company, it is clear that the comments of Mr. Hunt, as to some of the works and plant of the Company being more or less obsolete, are admitted, as allusion is made to the large amount which would be involved in reconstruction, and its consequent charge on revenue.

Your Sub-Committee consider it would much assist them in their deliberations when investigating the whole question of the gas undertaking if the Directors would favour the Council with an approximate estimate of the expenditure they think would be required to place the entire production of gas on the most advanced modern practice, and what would probably be the saving in cost of manufacture if such improvement were effected. Your Sub-Committee feel that the Gas Directors may reasonably be asked for this information in view of the peculiar and exceptional position which the Company holds towards the gas consumers in Liverpool.

Your Sub-Committee admit that the Directors may feel disinclined to embark in large and costly changes which promise no immediate benefit to the shareholders, but which may be regarded differently from the consumers' point of view, and therefore might have to be carried out by mutual arrangement, between the Corporation on behalf of the consumers and the Gas Company as representing the shareholders.

For the present your Sub-Committee do not think it necessary to deal with the points in paragraphs 1, 2, and 3, until the particular points in this report have been dealt with.

[One of the local papers thought it probable that this question would be brought before the Council at their meeting yesterday.]

## THE PROPOSED PURCHASE OF THE FALMOUTH GAS AND WATER WORKS BY THE CORPORATION.

### Report by Mr. A. Silverthorne.

A Meeting of the Falmouth Urban Sanitary Authority was held yesterday week—the MAYOR (Mr. H. Liddicoat) presiding—to consider a report prepared by Mr. A. Silverthorne, Assoc.M.Inst.C.E., on the condition of the local gas and water works, and the probable effects of their purchase by the Corporation. The suggested acquisition of the undertakings was alluded to in the "JOURNAL" for Sept. 15 (p. 509).

Mr. Silverthorne deals first with the gas-works, with regard to which he says that, upon the basis of the latest working of the Company, there is a prospect of a profit of £2369 in the first year in which the Corporation can get possession. The invested capital in the undertaking is £13,500; and the value does not exceed, upon a most liberal computation, £33,750; while he is of opinion that several points likely to reduce this amount might be submitted to an arbitrator. Falmouth presents unexampled opportunities for cheap gas; and when coal is cheap, the price should not exceed 2s. 9d. per 1000 cubic feet. If the works were purchased for the sum of £33,750, the liability for interest and sinking fund would amount to £1458 per annum. The cost of an Act of Parliament would be about £1200. The purchase is, therefore, one which he confidently recommends.

With reference to the water-works, Mr. Silverthorne states that, while no difficulty was placed in the way of an examination of the works, the Manager (Mr. J. G. Cox) said he was instructed to afford him no other facilities, and declined to furnish him with particulars as to the supply and other details. The conclusions at which Mr. Silverthorne has arrived are therefore based on inferential data. As Falmouth and Penryn, which are supplied by the Falmouth Water Company, have a joint population of 16,000, the average daily supply at 25 gallons per head is 400,000 gallons. This ought to be guaranteed by a storage capacity amounting at the very least to 120 days' supply—namely, 48 million gallons. Assuming the reservoir to have a capacity of 60 million gallons, he infers that the works may be equal to the needs of the two towns. But the limits within which compensation water can be given to the mills are restricted; and the Company are altogether unable, with so small a reservoir, to comply with their parliamentary obligations. The compensation clauses have proved unworkable; and Parliament ought to be applied to for a modification of them, so that the supply to the towns may not be jeopardized in dry seasons, nor the flow of water in the College stream suspended. These considerations should strengthen the inducement for promoting a Purchase Bill with clauses for effecting these objects; and they ought to secure for the Bill the co-operation of Penryn, which is injuriously affected by diminution of the flow of the College stream. The water Mr. Silverthorne pronounces to be of good quality; and if the occasional turbidity and traces of organic matter, due probably to peat, were removed by sand filtration, it would, he says, be in all respects perfect. Pointing out that the Corporation would only be able to charge for water upon the net rateable value, he remarks that the ratepayers

would experience an immediate relief of water-rates as a result of the transfer of the undertaking; and he goes on to consider whether this relief could be maintained without the liability of a rate-in-aid. The share capital of the Company is £35,000, the dividends upon which amount to £1850; and there are also mortgage debentures to the extent of £8750. Powers conferred under an Act of 1891 for raising additional capital have not been exercised. Mr. Silverthorne values the stocks issued at £47,300; assuming that the Company could successfully resist any claim in respect to not having enlarged the upper reservoir if that should prove to be the case. The loans to be taken over would swell the amount to £56,050. The interest and sinking fund on this amount would be £2267 annually; while the net balance of profit of the undertaking last year was only £2080. Mr. Silverthorne calculates, however, that £385 would be saved by the abolition of Directors' fees and London expenses, and an item of commissions. The working expenses would then be considerably in excess of the usual allowance of 25 per cent. of the water-rental. Moreover, the revenue is increasing at the rate of 3 per cent. per annum. Taking the several items, he calculates that by 1898, the first year in which the Corporation could obtain possession of the works, there would be a surplus of £500, after meeting the liability for interest and sinking fund; but this surplus would be neutralized by the diminution of the revenue, owing to the substitution of the net rateable value for the rental as the basis of the water charges. The possession of the undertaking upon these terms would, he thinks, be an unquestionable benefit in the future, on account of the increasing revenue.

If the Corporation decide to promote a Bill to give effect to section 69 of the Falmouth Gas Act, Mr. Silverthorne recommends that the purchase of the water-works should be also included. The gas purchase scheme could encounter no opposition in Parliament; and if the purchase of the water undertaking were resisted, he has no doubt the Corporation would prove successful with a joint scheme, or that the gas section would materially contribute to carrying the water scheme. The fact that the Water Company's affairs are managed from London, and that it is an "alien" Company, and not a local one, affords further grounds for anticipating a successful issue.

In the course of a discussion as to procedure which followed the reading of the report, several members of the Corporation expressed the opinion that there was a lack of unanimity on the subject, and that there was a movement to let the whole scheme drop. The Mayor thought that both the gas and the water supply should be under municipal control; and as the report demonstrated that the venture would be profitable, they ought not, in his opinion, to let this opportunity slip. It was decided that the Town Clerk should take the necessary steps to give effect to Mr. Silverthorne's recommendations in regard to both the gas and the water works.

## CARLISLE CORPORATION GAS AND WATER UNDERTAKINGS.

### The Profits on the Departments—The Size of Flushing-Cisterns.

At the last Meeting of the Carlisle Town Council, the report and accounts of the Gas and Water Committee for the year to June 30 last were presented. The chief features of these (and also of a report by the Engineer, Mr. C. B. Newton) were noticed in our issue for the 6th inst. From the minutes of the Committee, it appeared that they had passed the following resolution: "That the sum of £8148, being the balance profit of the Gas Department for the year ended June 30 last, be paid over to the city fund; and that the sum of £5038, being the balance profit of the Water Department for the year ended June 30 last, be paid over to the district fund."

Mr. CORBETT (Chairman of the Committee), in moving the adoption of the minutes and the report and accounts, referred first to the finances of the Gas Department. He said that the amount to be paid into the city fund in respect of the past year's working was £8148; this being the profit of the undertaking after payment of income-tax and other charges. But the members would bear in mind that, after this reached the city fund, there were certain payments to be made out of it in respect of interest on loans and repayment of loans. These amounted to £3429; so that the net amount available for reduction of rates or other public purposes was £4719. Now, according to the Corporation blue book, a 2s. 10d. district rate realized £21,847, or about £643 for each penny of the rate; so that this amount was equal to a rate of about 7d. in the pound. Then if they took the total capital expended on the works, it would be seen that the gross profits were equal to a dividend of about 6½ per cent., and the net to 3¼ per cent. Considering the low price charged for gas in the city—2s. 3d. per 1000 cubic feet—and the low charge for street lamps, he thought the members would agree that this result was very satisfactory. As to the loan capital, loan No. 1 would expire next year, when the last payment of £1225 would have been made; so that there would afterwards be a larger amount at the disposal of the Council. But it would be necessary at no distant date to raise other loans for extensions. At the works everything had been kept in the best working order; and when improvements at the chemical works were completed, he hoped they would get a better return from them. The low price of ammonia told very much against the residual products. Then with regard to coke, no doubt the mild winter had had a deal to do with the price of it, and materially affected the revenue under this head. But although they had had low prices for these two products, he was glad to say they had done better in the price of tar. The Manager reported that the number of consumers using penny-in-the-slot gas-meters was 1456; and the amount received from these meters in pennies during the past year was £1172. Having stated that the contracts for coal for the current year were all favourable, the Chairman turned to the question of electric lighting; remarking that the Committee hoped to take the matter in hand early in the coming year, so as to ensure the work being done within the time granted by their Order of 1895. Passing to the accounts of the Water Department, he said the amount of profit on the year's working which was payable into the district fund was £5038. Out of this the payments of interest on loans and repayments of loans amounted to £2582, leaving a net amount for the relief of the rates of £2456, which, if calculated in the same way as the gas profits, was equal to a rate of nearly 4d. in the pound on the rateable value of the city. He also incidentally pointed out that the amount of profit represented a return of nearly 7 per cent. on the gross capital employed in the undertaking, or 3½ per cent. net. During the past year, the Committee had had under consideration the question of a new supply of water for the city, and had hoped to be able to lay the scheme before the Council that day; but, owing to the unfortunate illness of Mr. Newton, they had not been able to do so. On the whole he thought the Council and the citizens generally were to be congratulated on having two such valuable properties as the gas and water works and on the results of the past year's operations. Although the total value of both undertakings was stated in the accounts as close on £200,000, he considered their actual value as a going concern to be a much greater amount.

Mr. COULTHARD, in seconding the motion, stated that £500 had been added to the reserve fund, and public lighting had cost about £1000 more than had been set aside for it; so that £1500 must be added to the increase which had been mentioned, in order to give a just return for the gas-works. They had sold £25,000 worth of gas; there had been an increase of 409 penny-in-the-slot meters; and 52 additional public lamps had been erected. This all went to show that the increase in the consumption of gas was going on. The Chairman had told them that the gas-works loan No. 1, now standing at £1225, and the water-works loan No. 1, amounting to £1033, would be paid off next year; but he was glad to say that they had already been paid off, so that there would be £2258 less to pay off next year. There had been a loss on coke and sulphate of ammonia; but there was a little gain on tar, so that on bye-products there had been a loss of £535. They would agree with him that the price of both gas and water was at a very low figure now; and they could not very well lessen it. He had a suggestion to make. Next year would be the sixtieth year of the reign of Her Majesty; and he considered that on that occasion they should undertake the building of a new Town Hall for the city in commemoration of her long reign. In his opinion, they might make an attempt to go on with its erection from the gas profits.

Mr. BUCK criticized the policy of the Committee in not altering the sum put down for depreciation. He did not think it was a business-like policy to adopt. If 2½ per cent. were taken off the enormous capital sum of nearly £125,000, he considered it would be a safer policy, and would obviate the necessity of the Gas Committee applying to the Local Government Board for loans in the future. It would, however, be said that the Committee would not then be able to hand over so much to the reduction of the rates as they did at present. He admitted that; but if they took money out of one pocket and put it into another, he did not see what good they were doing. They were taking credit for a larger sum than they had earned. Should anything occur which would require the removal of the gas-works from their present unsuitable situation, the city would be mulcted in enormous loss; and he thought the wise policy would be to reduce the value put upon the property year by year.

Mr. REDMAYNE said the policy of the Gas Committee appeared to be to give as low a quality of gas as possible at the expense of large profits. He thought the Committee might consider whether they could not reduce the charge for gas used for heating, cooking, and manufacturing purposes.

Mr. FRENCH also complained of the quality of the gas, and suggested that the Committee should either lower the price or supply the same quality as in the time of their late Engineer.

Mr. ATKINSON asked if it was a fact that a circular had been issued directing plumbers to fix 2-gallon instead of 3-gallon flushing-cisterns in water-closets.

Mr. CORBETT, replying to the discussion, said the quality of the gas was the same as in the time of Mr. Hepworth; and any member could have this verified by going to the works, where he would see that the gas now made would register 16·90 candles by the legal test now in use; whereas if the apparatus used by Mr. Hepworth were employed, the same gas would register 19·3 candles. With reference to Mr. Atkinson's remarks as to the reduction in the size of flushing-cisterns, he maintained that, if the closets were properly constructed, cisterns holding from 2 to 2¼ gallons were sufficient.

The TOWN CLERK said there had been a tendency to enlarge rather than diminish the size of flushing-cisterns; and if the Gas and Water Committee acted on this circular, they might come into conflict with the Health Committee, which he strongly urged should be avoided.

Mr. CORBETT replied that the tendency had been rather the other way.

Other members having protested against the issue of the circular as to the size of flushing-cisterns,

Mr. COULTHARD stated that the circular was not brought before the Committee; and they were therefore not to blame.

Mr. DIXON urged that, if the Manager had sent out the circular on his own responsibility, the Committee should see that it was withdrawn.

The motion was unanimously adopted.

**Heating Public Buildings by Gas.**—The Royalty Theatre, Dean Street, Soho, which will open on Saturday next, after being redecorated, will be heated throughout by an installation of "Lux-Calor" gas-stoves, supplied and fitted by Messrs. Ritchie and Co.

**The British Pure Acetylene Gas Syndicate, Limited,** is the title of a Company formed with a capital of £50,000, in £1 shares, to acquire, wholly or in part, any patents, *brevets d'invention*, licences, concessions, &c., conferring the right to use any secret or other information as to the production, treatment, storage, application, distribution, and use of gas, and of any apparatus therefor, or generally any invention which may seem to the Company capable of being profitably dealt with; to construct and maintain gas-works; to light with gas, or otherwise, roads, streets, houses, buildings, &c., to supply heat, power, or force, whether by means of gas, coal, coke, electricity, oil, or any other means; to carry on business as manufacturers of acetylene gas, and to lay down mains and pipes for supplying the same; also as mechanical engineers, manufacturing chemists, wood workers, metallurgists, printers, die sinkers, &c.

## WAGES AND HOURS AT THE LEEDS GAS-WORKS.

### A Vote of the Men on the Question of a Strike.

The adverse decision of the Leeds Corporation Gas Committee upon the demands of their workmen for certain advances in wages and concessions in the hours of labour, has been submitted, by the officials of the local branch of the Gas Workers' Union, to a vote of the men—the question which each individual was called upon to answer being whether he considered himself affected by the decision of the Committee, and if he was prepared to hand in his notice. The method of voting required that each member of the branch should sign his name to the paper, and also state where he was employed; so that in case of a majority being in favour of a strike, no minor question could arise. A meeting of the men was held last Sunday afternoon to receive the result of the vote. There was a large attendance, and the discussion lasted about two-and-a-half hours. Eventually it was announced that a resolution had been passed to the effect that, although there was a considerable majority of the men in favour of handing in their notices, that majority was not sufficiently large to warrant the general handing in of notices, especially having regard to the fact that many of the men now employed as gas workers had recently passed through a severe strike in connection with the building trade. It was, therefore, considered that it would be unfair to ask them to engage in another dispute at the present time, though the men were of opinion that the Gas Committee had not dealt with the matter as fairly as they might have done, seeing that the stokers had not received any advance during the last twenty years, and were now doing the same amount of work in eight hours that they formerly did in twelve. It was accordingly decided to again approach the Gas Committee on the question.

## THE GAS SUPPLY OF VIENNA.

### A Financial View of the Question.

As bearing upon the matters referred to in the paragraph on the above subject which appeared in the "JOURNAL" last week, we reproduce the following article from last Friday's "Financial News":—

One seldom hears the name of the Imperial Continental Gas Association, for the simple reason that it has been a consistently successful undertaking, and thus enjoys the blessedness attributed to those whose annals are dull. All of a sudden it has come to bulk pretty largely in the public eye, owing to the discussion in the Vienna Municipal Council on the future gas supply of the Austrian capital. For over half a century, Vienna has been lighted by the Imperial Continental Gas Association, which has never had any difficulty in keeping on perfectly good terms with the authorities; the desire and determination of the Association to do its best for its customers having always been recognized by the Municipality. The contract with the city is terminable at the close of 1899, provided the authorities give notice to the Association on the 31st of this month. The debate begun in the Municipal Council on Wednesday is on the question whether the Association should be bought out or the corporation should begin the manufacture of gas on its own account. The telegrams in some newspapers, declaring that the Council has already decided to build gas-works of its own, are premature—no vote having been taken on the subject.* At the same time, the fact that Dr. Lueger is in favour of building municipal gas-works creates a strong presumption that the Council may follow his lead. The anti-Semitic majority which he controls is, for the time, in complete command of the Council; and, in order to fully understand the situation, it must be borne in mind that the majority is essentially anti-capitalist and socialistic. Anti-Semitism is, in Austria, a rallying-cry which unites the hare-brained and the discontented in much the same way as Mr. Bryan's "platform" in the United States suits all those whose hand is against every man.

The Vienna Council has three courses open to it, in view of the expiration of the Imperial Continental Gas Association's contract: It may either renew the contract, buy out the Association, or enter into competition with it. The first two are obviously the easiest for the city and the more advantageous for the Association. The citizens, so far as their opinion can be ascertained, are in favour of the first. The ancient Viennese trade guilds are still potent and vigorous; and no fewer than 42 of these organizations—representing all that is energetic and businesslike in the trading community of the city—have petitioned for the continuation of the existing status. The second alternative attracts many outside the Lueger influence. The Association's works and plant have been valued at 16,000,000 fl.; and for this price—with any additions which the development of the business between the present time and 1899 may require—the Association is ready to sell. The construction of new gas-works and the laying of new mains by the Municipality are estimated to cost 30,000,000 fl.; so that economy alone would point to the acquisition of the Association's undertaking. But there are other strong arguments, besides that of economy, against the proposed entry of the city into the business of gas making. The almost daily improvement in electric lighting makes it seem injudicious for a great city to tie itself down to the older illuminant, and to pledge its credit in support of the continuance of gas for street lighting. Then there is the problem of accommodating new mains in the streets of Vienna. The city has recently been re-drained, and so many of the streets are narrow—mere lanes—that it is doubtful if there is room enough for a second set of gas-pipes as well as the sewers; the more so as the Municipal Council seems to think the existing mains are in many cases too small to provide for the growing needs of the city. Those familiar with the narrow streets and *gasses* of Vienna will see this is no imaginary obstacle to the project supported by Dr. Lueger.

Another and more awkward problem which will face the Municipal Council, if it resolves to build its own gas-works, will be that of time. To light the whole of the city would entail the laying of no less than 500 miles of gas-mains. It is now October, 1896, and if the Municipal Council is to supplant the Imperial Continental Gas Association by December, 1899, the time is very short. True, the Association can be called upon to continue the supply for another year; but even four years will hardly suffice to lay 500 miles of gas-mains. The climate of Vienna has not the infinite variety of our own; but it is not conducive to regular open-air operations. The fifty years' experience of the Imperial Continental Gas Association proves that in Vienna not more than 200 working days can be depended upon in a year; and so, if the Municipal Council wishes to be ready with its gas-mains and connections by 1900, it will have to set gangs of men to work to tear up the streets at once. It so happens that the jubilee of the Emperor Francis Joseph's accession falls in 1898, when Vienna will presumably be *en fête*. An international exhibition is also in preparation. With two such events in prospect, it need scarcely be said that the tradesmen and residents of Vienna do not look forward with delight to the idea of having the streets excavated from end to end within the next few years, especially as during the long winters the work would have to be left in whatever state it happened to be before the weather stopped it. Those of us who know what it means to have the Strand "up" or Piccadilly under repair for a month or two, can realize the inconvenience and misery caused by even a partial interruption of traffic in fairly broad thoroughfares. What Vienna would be like during and after the laying of 500 miles of gas mains, in four years, is beyond imagination.

The Imperial Continental Gas Association is not worrying itself as to the probable decision of the Municipal Council; for, in any case, it will remain in Vienna as a private company, supplying those customers who may prefer not to have their houses and shops thrown into disorder so as to make new connections with the municipal gas-mains. Besides, it is by no means certain that the higher authorities would permit the Municipal Council to play ducks and drakes with the interests of the Austrian capital. The Reichsrath might have something to say; and the Emperor not long ago dissolved the Council altogether, and put Vienna in charge of an Imperial Commissary, rather than allow Dr. Lueger to become Burgomaster. He is now only Deputy-Burgomaster; but the actual occupant is a nonentity, under the control of the anti-Semitic leader. The Emperor may be the less likely to stand any nonsense from the Municipal Council if its vagaries threaten to interfere with the success of the jubilee celebrations of two years hence. It may not be left to the Emperor or the Reichsrath to protect Vienna; for there is every probability that, if the Council commits the city to an expenditure of 30,000,000 fl. and dear gas, instead of to 16,000,000 fl. and cheap illumination, the citizens will repent of their "anti-Semitic" enthusiasm, and send Dr. Lueger and his followers packing. In point of fact, then, the decision to be taken as to the future of the Vienna gas supply is far more momentous for the socialistic majority than for the Imperial Continental Gas Association.

* The matter was under discussion in the Municipal Council for three days last week. A division was expected on Friday; but it was deferred—possibly till this week.—ED. J. G. L.

**The New Retort-Settings at Walsall.**—In the paragraph on this subject which appeared in the "JOURNAL" last week (p. 758), the new retort-stack which was inspected by the Gas Committee on the 15th inst. was stated to consist of ten beds of eight retorts. The latter number should have been sixteen.

**Water Gas for Oldham.**—Three firms have submitted plans and particulars to the Oldham Corporation Gas Committee for the construction of water-gas plant at the Hollinwood works. The cost is estimated at £13,000 or £14,000. A Sub-Committee has been appointed to investigate the question of storage capacity with a view to the adoption of water-gas manufacture.

**The Calne Town Council and the Water Supply.**—The Calne Town Council, being of opinion that they could work the local water supply to more advantage than the Calne Water Company, applied to the latter to ascertain on what terms the undertaking may be acquired. The Directors replied that they have sufficient water for public and private purposes, and do not see why they should be unable to meet the reasonable requirements of the Council. They find, however, that the existing agreement must be revised and modified. They will therefore determine it at the earliest possible date, with a view to a new agreement being entered into; but they have no intention of selling their undertaking.

**The Supply of Water at the East End during August.**—The report of Major-General Scott, R.E., the Official Water Examiner for the Metropolis, on the water supply of London in August,* contains only a brief reference to the effect of the then prevalent drought upon the supply in the district of the East London Company, about which so much trouble was made by a certain section of the Press. Though the constant service was supended, the water was on for six hours daily; and the supply per head was 26·37 gallons, as compared with 33·82 gallons in the corresponding month of last year. General Scott has made special reports on this matter from time to time to the Local Government Board; and therefore he considers it unnecessary to deal further with it in his monthly report.

**Ceara Gas Company, Limited.**—In the report of the Directors of this Company to be presented at the annual general meeting on the 30th inst., they state that the additional consumption of gas in the year ending June 30 last is very gratifying; and but for the increase of £601 in the exchange, it would have resulted in additional profit. In consequence, however, of the depreciation of the purchasing power of the milreis, the working expenses in Ceará are all considerably higher. The result of the year's operations is a net profit of £3099, which, added to the balance brought forward (£557), gives a total of £3656. Deducting the interim dividend paid in April last (£1611), there remains £2045 available for division. The Directors recommend the payment of a dividend for the six months ended June 30 of 5 per cent. on the preference shares (less tax) and of 4 per cent. on the ordinary shares (tax free); making together £1911, and with the interim dividend already paid, 10 per cent. on the former and 7 per cent. on the latter shares for the year. The balance carried forward will be £134.

* Issued last week only.

## DUNFERMLINE GAS-WORKS ARBITRATION.

### Edinburgh—Saturday, Oct. 10.

(*Before Mr.* H. E. JONES, M.Inst.C.E., *and Mr.* W. FOULIS, M.Inst.C.E. *Arbitrators. Mr.* J. SHIRESS WILL, Q.C., *Oversman.*)

The proceedings in the arbitration under the Dunfermline Gas-Works transfer were continued to-day, at the Balmoral Hotel.

Mr. A. ASHER, Q.C. (Dean of the Faculty of Advocates), and Mr. KINCAID MACKENZIE appeared for the Company; and the Corporation were represented by Mr. T. SHAW, Q.C., and Mr. CLYDE.

Mr. *Corbet Woodall*, M.Inst.C.E., who was the next witness called, said he had visited Dunfermline, and examined the property of the Company. He inspected the district supply; and he had studied the accounts which had been produced, and the figures. He had also generally made himself acquainted with the history of the Company. He found that there had been a steady and regular growth in the business down to the year 1893. The increase averaged 4 per cent. compound from 1876. The increase in 1893 over 1892 was 8 per cent., which was an unusual proportion in Dunfermline. The growth in the demand had overtaken the producing capacity of the old works, which had served since the year 1828. He did not speak from personal knowledge of the old works; but having seen the site, he could well believe what he was told—that they were completely overtaken. They were inconveniently situated for works at the present day, because they were surrounded by property; and however carefully the operations of the Company might be conducted, they must occasionally be offensive to people living on their borders. The site was small; and there was no connection with the railway. He was satisfied as to the wisdom of the Company in removing their works to a more convenient spot, where there was room for further extension, and where communication could be had directly with the railway. The new works were necessary to provide for the needs of the consumers; and it was, besides, certainly an advantage to the town to have the gas-works taken out of it. The date when the new works were brought into use was August, 1894; and in his opinion the results had justified the policy of the Directors in changing the site. He found that there had been an increase in the quantity of gas made and sold during the period the new works had been in operation. He had had a fair amount of experience in regard to the occupation of the same field by electric light and gas; and he found that the competition of electricity had not tended to reduce the revenue of gas companies. He spoke not only as to English companies, but also towns on the Continent.

Mr. FOULIS: That depends very much on the price at which gas is selling, does it not?

*Witness:* I think not, because as a rule the price of gas and of electricity would be governed by the same factors. For instance, I am supplying gas at 12s. 6d. per 1000 cubic feet, and I am also supplying it at 2s. 6d.; and I am no more afraid of the competition of electricity in the one case than in the other. Continuing, witness said that proximity to a coal pit, which should be favourable to an electric installation, would also be favourable to the supply of gas at a cheap rate.

By Mr. JONES: He should say that the price of coal entered almost as much into the cost of electricity as of gas. That was because there was no residual.

Examination continued: Down to the time of the removal of the works, he found that the capital, as recorded in the books, was low. Immediately before the removal he thought it was £478 per million cubic feet sold. This showed that the capital had not been extravagantly spent down to that time; but it was also low because the Company had been using the works up to their extreme limit. The probability was that every retort was at work, and the whole apparatus taxed up to the full; and in this way they were getting the fullest possible value out of the undertaking immediately prior to abandoning it. There was no margin of plant; and the capital was earning up to its utmost. In the years 1889, 1890, and 1891, he believed the profits earned were sufficient to pay the shareholders a dividend of 10 per cent. as appeared from the statements produced. The price of gas in those years was 3s. 7d., 3s. 5d., and 3s. 7d. per 1000 feet respectively without taking the discounts into account. Adding interest on mortgages and dividends together, he found that for the year ending May 31, 1896, the cost per 1000 cubic feet was practically 22d. In that year the dividends amounted to 20½d. per 1000 feet, and the interest on mortgages 2·03d. As they had heard, this was more than was earned in the year. Supposing the works were increased so as to put out, instead of 58 millions, the 80 million feet that had been referred to, the cost would then be about 16d.; so that there would be a saving of about 6d. The difference would be as to what was divided, but not as to what the capital actually earned. He took the interest as affecting the question of the possibility of reducing the price of gas. The present business required 22½d. per 1000 cubic feet to pay 10 per cent. on the capital of the Company and 4 per cent. on the debentures. If the business could be increased to 80 million cubic feet—which, he maintained, could be done without increased capital—the cost for dividend and interest would be 16d. If the output were raised to the full capacity of the works—160 million cubic feet a year—allowing fully for the money requisite for extending the works and assuming that the Corporation paid to the Company the amount of their claim, and that they could raise money at 4 per cent., including their sinking fund, it would then cost them 9·8d. per 1000 cubic feet to pay all their charges.

Mr. FOULIS: But we are valuing the works as they exist now, not as they will be fifty years hence, because that would lead us into all sorts of speculation?

*Witness:* I perfectly agree; and I must say at once that this little calculation was made simply because of a question put this morning as to what chance there was of a reduction in the price of gas in Dunfermline.

Further examined, witness said that the capital of the Company was raised in five years from £25,462 to £62,896. No burden was imposed upon consumers of gas. The increase of capital was borne partly out of increased business, partly out of economies in the new works, and partly by reducing the dividend paid to the shareholders. He was sure it was the opinion of everybody who had seen them that the new works were admirable—very well designed and executed. In his opinion, they were sufficient for the needs of the town for a long time to come. If he had been asked to design the works, he was disposed to think that he would have put in a duplicate boiler and exhauster; but Mr. Newbigging was perfectly right in saying that there were scores of works working with a single boiler and a single exhauster. If there had been duplicates, they would have made an addition to the fixed plant account, but no alteration upon the profits. As regarded the suggestion that it would have been advisable to have had six retorts in the setting instead of eight, he thought the balance of advantage was in favour of Mr. Newbigging's design of having eight. The point was that the unit was a large one of either getting up or letting down. As there was fairly good gasholder room, he thought the interval between the eight and the sixteen might be fairly got over. The retorts would have to lie idle for a little while; but the advantage of the eight was that only one fire was required, and practically the consumption of fuel would be very much the same as if the fire were heating only six retorts. He inspected the mains along with Mr. Newbigging and Mr. MacPherson. It was suggested that new ones should be put down, at a cost of £1380. This was certainly not a necessity at present. With regard to unaccounted-for gas, he took Mr. Newbigging's statistics, which showed that it was low for Scotland; and furthermore, the initial pressure at which gas was supplied from the works showed that the mains could not be too small for the business. The maximum really was 25-10ths, and that only when all the factories were in full swing. He inquired carefully about the pressure; and was told that the only complaint was that it was excessive on the top of some of the hills. He thought the depth of the mains was amply sufficient. He should be exceedingly glad if he could get a depth of 18 inches in London, over, he might say, miles of mains. The soil in Dunfermline was clay; and he could not say it was calculated to preserve the metal of the pipes for a considerable time. The composition of clay differed very much; but, judging by the results, this was a good soil. As to the price of gas in Dunfermline being regulated by the charges ruling in Edinburgh, Glasgow, Greenock, Kirkcaldy, and Paisley, he thought that to bring Edinburgh and Glasgow into any such list was distinctly unfair to Dunfermline; the conditions of production being so different in these places. He made no inspection of the meters. His valuation of the undertaking proceeded upon the profit earned in the year ending May 31, 1896. He did not consider, in the present case, that there was any other year which gave assistance in ascertaining what the maintainable profit was, on account of the change in the conditions of the manufacture of gas, because of the transfer to the new works.

By Mr. FOULIS: The entire improvement on account of the new works was practically embraced in the reduced price of coal and the larger make per ton.

Examination continued: Last year the gas made per ton of coal carbonized was 9949 cubic feet. In the old works, the yield was low—probably because they were being worked beyond their capacity. At any rate, there had been an increase of 1000 cubic feet per ton in the yield in the first full year of the new works. The increase, as compared with 1895 was 1400 feet per ton; but as compared with 1890, it was only 5500 feet. In 1896, there was 5½ million cubic feet more gas produced than in 1894, with a reduction of 135 tons of coal. The new furnaces were regenerative. There was not necessarily a better yield per ton from these furnaces than from the old style; but the heat was more evenly maintained, and so better results were generally obtained from them. The first figure in his valuation was profit earned in the year ending May 31, 1896, £5233. From this he had made a certain deduction of expenditure upon repairs and renewals of works, mains, and meters. He put it at 5d. per 1000 cubic feet, which brought out £1220. He then deducted the actual expenditure for one year, which was £684; and this left £4697, which, in his view, was the maintainable profit of the Company. The actual expenditure of £684 was, judging by experience in other places, insufficient to maintain the works and renew them. He thought £1220 was requisite for the purpose; and he had added the difference between the two sums—viz., £536. He had gone farther than he felt was quite right in putting the figure at 5d.; but had it not been for the fact that the expenditure on meters was also low, he should have said that something nearer 4d. would have been sufficient to maintain and renew the works. He said so because wages were lower in Scotland than in England; and he regarded as an important point that, from the nature of the material carbonized, a smaller extent of generating plant was required for a given output. The average output in works of this size in England he would put at about 6000 cubic feet; while in Dunfermline they were making 8300 cubic feet, and they could very well make more than that, per mouthpiece. Consequently, the number of retorts was smaller than it was for a similar output in England; and, as the expenditure on wear and tear was chiefly in the retort-houses, this made a very important deduction as compared with English experience.

Mr. FOULIS: Let me understand what you mean, because I do not think you are right. You say that the repairs on retorts should be less here than in England?

*Witness:* Yes.

Does it not occur to you that, as they are worked at higher heats, they should require a great deal more repairs?—I do not think so. I hardly believe that is borne out by the experience of Glasgow.

Mr. JONES: If the retorts, by reason of the coal used, take so many charges daily, with double the amount of return—subject to some little consideration as to high temperature—you have one retort against two to repair?

*Witness:* That is my view. It is quite common, I understand, in Scotland to work off charges in three hours; whereas in England we generally leave the coal in the retorts for six hours.

Mr. FOULIS: But you will agree with me that everything depends upon the temperature of the setting, as to how long it lasts?

*Witness:* I do not think a heat within the limits used in Scotland would exercise a very material influence upon the life of a retort. I

may say that in our Continental works, we use a heat as high as any employed in Scotland; and the duration of our retorts there is about as good as in the cases where low heats are in vogue.

By the OVERSMAN: He had seen furnace arches where the bricks had vitrified, even on the ordinary firing system, in London. That might depend partly on the quality of the bricks.

Examination continued: He mentioned this as one reason why he thought 5d. per 1000 cubic feet in this case was more than an ample allowance. From the £4697 which, in his opinion, was the maintainable profit of the Company, he deducted interest on the debentures to be taken over by the purchaser. Taking the £481 from the £4697, they had £4216 divisible among the shareholders. He agreed with Mr. Newbigging in taking 26¾ as the number of years' purchase. That was to say, he thought the basis of a return of 3¾ per cent. to the shareholders was a reasonable one. He considered that an investment of this sort should yield 3¾ per cent. The shareholder had a right to expect that he would be able to re-invest the money paid to him in an equally good security; and in order to do this, they required to take the rate of interest he had mentioned. Except as affecting the question of the security of the investor, the capital value did not enter into the consideration of what should be paid by way of compensation. Multiplying £4216 by 26¾, they had £112,398. He added 10 per cent. for compulsory sale, because this was a sort of stereotyped rate when compulsion was admitted at all. In the present case, he considered there was compulsion. The 10 per cent. amounted to £11,239. Then he made an allowance for surplus works, amounting to £6500. He had prepared a statement showing the value of these, as follows: Retort-house, coal-store, chimney, and railway-siding, equal to an additional output of 500,000 cubic feet per day, £5000, less value of retort-bench £2240—leaving £2760; purifiers have an excess capacity equal in the purifier to 886 cubic feet, which, at £2 per foot, makes £1772; sundry buildings, £500; gasholder excess capacity 75,000 cubic feet, at £20 per 1000 cubic feet, £1500—total £6532. He had tested the accuracy of his estimate of the surplus works by an alternative method, which worked out in this way. The works, with the additions set out, were equal to an output of 500,000 cubic feet per day, which, at £250 per million, was worth £25,000. Additions required to bring the works up to that size: Retort-bench, 64 retorts at £35, £2240; condensers, £600; engine, exhauster, boiler, and setting, £750; scrubber and connections, £600; tar well and pumps, £300; meter and foundations, £450; general connections, £400; gasholder for 500,000 cubic feet, £10,000—total, £15,340, which, deducted from the £25,000, left £9660. That was to say, works which would cost £25,000 if they had to start upon them, could be had at an expenditure of £15,000. Therefore there was already on the ground the equivalent of £9660. But before they reached a demand for 1 million cubic feet per day, which that supposed, they would have to pay interest upon them for some time. He thought that £9660 was a fair equivalent of the £6500 which he claimed.

By Mr. FOULIS: If the million per day were never wanted, all this surplus works went for nothing; but no one experienced in gas would have the slightest doubt that it would be wanted. To complete the valuation, there was the expense of winding up the Company, for which he allowed £1000; bringing up the total valuation to £131,137. In his opinion, this was the fair price which should be paid by the Corporation for the Company's undertaking, proceeding on the footing of entry being at May 31, 1896, and the stock in hand being as appeared in the balance-sheet at that date, or, if at any other date, then the stock in hand to be valued at that date.

Cross-examined by Mr. SHAW: He had been engaged in several inquiries in regard to these matters. His view had changed as to the number of years' purchase—owing to the reduced value of money, for one thing. As the value of money went down, undoubtedly the amount to be paid for such an undertaking would have to be increased. This diminution had taken place steadily within the last few years. He gave evidence in the Stourbridge case; but in the Chesterfield case he was one of the Arbitrators. He probably said in the Stourbridge case that 25 years' purchase was sufficient; he did not remember, but he would take it so. That was a statutory Company. In his profession, there was a distinction made between statutory and non-statutory concerns, in favour of the former. He differed from the rough estimate that the difference was about the value of five years' purchase. He had taken it generally that the difference between the two was pretty well covered by the cost of obtaining parliamentary incorporation—two or three years' purchase covered it. He would not complain if they took it at three years. In this case, the Company was a non-statutory one; but in Scotland non-statutory companies had a position which they did not occupy in England. Taking the Stourbridge case to be 25 years' purchase (June, 1893), the result would be that, unless some distinction could be established, 22 years' purchase would be the correct figure in the present instance. He believed that between then and now such property had gone up in value fully three years' purchase. There was no instance he was aware of (in Scotland, England, or Ireland), of actual determination of value, to justify this position. He went purely upon the value of money then and now. But there was this also, he thought, that gas property was at present held in considerably higher esteem than it was at that time. He thought this was due to the fact that the passing years showed that the electric light competition, of which so much was feared, was of less consequence than it was thought it would be. Assuming that this Company was open to competition, it would make a difference in the number of years' purchase which he would assign for its value. He was afraid he could not say to what extent; but perhaps it might be one year. He was informed that the reduction of 10 million cubic feet in the year ending May, 1894, was almost entirely in the factories; and that it was accounted for by bad trade, and by the fact that two of them, who were large consumers of gas, had introduced the electric light. This was a peril which might occur again in the future; but he thought it fair to point to the fact that the loss having been once sustained, was not continuing, inasmuch as they had a very satisfactory increase from 1894 to 1895—probably due to better trade—and again from 1895 to 1896. He agreed completely that the growth up to 1893 would not be continued if there could be a repetition of these periods of fluctuating industry and the introduction of electric light. If they had repeated exactly the same circumstances, the same results would follow; but what he held, from a fairly large experience, was that even apart from an increase of population there was a constant increase in the demand for gas, and that this would go on in Dunfermline as it did everywhere else. Counsel spoke of the adoption of electric light; but he said that the introduction of incandescent gas lighting made such a probability very remote. The supply of a superb light by the latter means, at a rate so much cheaper than by electricity, was an important consideration with regard to factories. The introduction of the prepayment meter also had had an effect which had astonished everybody connected with gas supply. There had been no more interesting development—at any rate within his memory—and the result had been most marked in the increase of consumption. Bearing these things in mind, he had not the slightest fear as to the future of the demand for gas in Dunfermline. In addition to this, there was a considerable amount of building going on in the town; and gas-pipes were being put practically into the whole of the houses being built.

Mr. SHAW: Are you not aware of our general rule in Scotland, that when a house is being built it is fitted with gas to the top?

*Witness:* It increases my already high opinion of Scotch character; and I admit that it does decrease the field for prepayment meters.

By Mr. JONES: Of course, he would not expect electric lighting to make any inroad in the class of house to which coin-meters would be supplied.

Cross-examination continued: In Dunfermline, there was no public supply of electricity; and they would require a large demand to justify putting down plant. The chances that shops, &c., would adopt the light were very small. What he should have said about the increased yield, was that they had raised their output of gas by 10 million cubic feet, while they had reduced the quantity of coal carbonized by 130 tons. This meant 1000 cubic feet more gas per ton.

Mr. FOULIS: Is there any possibility of getting at the coal used in the works. There is a percentage given of cannel and shale; but there is as much variety in cannel as in anything else. Some is not worth 7s. per ton, and some is worth 27s.; so that, unless we know what coal they were carbonizing, it is useless to say that at one time they were making 9900 cubic feet per ton, and at another time 9300 feet.

*Witness* admitted all this; but he presumed there had been some care exercised in Dunfermline over the quality of the gas supply. They had not heard anything of a diminution in the candle-power of the gas; and if the Company had secured these better results by buying their coal more wisely, they were as much entitled to the benefit of it as if there had been a reduction all round in the value of coal.

Mr. SHAW: In 1895, there was 48 per cent. of cannel bought, and 51 per cent. of splint; whereas in the following year there were very different purchases—57 per cent. of cannel, and only 42 per cent. of splint.

Mr. FOULIS: Even that is not enough, because the 48 per cent. might really be a much more valuable kind of cannel. It is only wasting time to go over figures like these.

Mr. SHAW (to witness): You admit that these figures are perfectly valueless as to the output from the coal, unless we have first a full statement of the cannel and splint, and secondly of the kind of cannel and its gas-producing properties?

*Witness:* I do not admit anything of the sort.

Mr. JONES: Do not the prices give us an indication?

*Witness:* I am not sure that they would, because I know you can get from some low-price shales and cannels a large quantity of high quality gas. Continuing, he said that what he respectfully submitted was that this Company had been supplying, during a term of years, gas that had been satisfactory to the town of Dunfermline; and there was no evidence that they had changed the quality of it. If therefore they had managed to buy a mixture of coal which was equally effective, at a lower price, they were entitled to all the advantage of their better judgment, just as much as they would have been entitled to the advantage if there had been a general fall in the price of coal.

Mr. FOULIS: I must say it would be more satisfactory if we could get some information, because, while Mr. Woodall says there is no indication that they have changed the quality of gas, so far as evidence is concerned there is no proof that they have maintained it; and judging from my experience of cannel and the yield of gas from that class, one would like to know what quality of gas they were getting.

*Witness:* I am sure, from my knowledge of the Directors of the Company, you have only to ask for the information and it will be given to you. In further cross-examination, witness said, in connection with the decision of the Company not to spend further money on providing for any extension of the old works, that he did not think it was unwise not to place a considerable sum to reserve for new works. If they were advised by their Engineer that they could remove the works to a new site without any loss of profit, he really did not see why they should create a reserve fund to help the capital account. He expected that the reduction in the charge for gas in 1890 was due to a considerable fall in the price of coal. There was no benefit from the fall of coal in 1896, because of the necessity of paying interest upon their capital. The dividend was increased from 6 to 10 per cent. Assuming the dividend to have been continued as before, it would have cost, together with interest, about 1¼d. per 1000 cubic feet, and the Company had a gross profit of 21d. The life of a retort was about 700 days of work, which would be spread over three seasons. He should think there had been no expenditure upon renewing any retorts that were started in 1894; so that they were now in the position that, within a very short time, they would have to renew them. He should think the cost of renewing a bench of retorts would be about £160. Over a period of six years, the actual expenditure upon retorts came out at an average of 27d. As to the £1074 of capital per million cubic feet, he was aware that this figure largely exceeded the average given in Field's "Analysis;" but there was not a works in the analysis which compared with Dunfermline in point of size. They were all much larger; and yet there were several with a higher capital than that in Dunfermline. He should expect the leakage to come down to between 5 and 6 per cent.; and this would be a little reserve found open to be tapped by the purchasing body.

In re-examination, the witness said that, in addition to the general

onsiderations which had induced him to take the concern as being a 3¾ per cent. investment, he had in view the special circumstance of Dunfermline—the fact that it was a comparatively small undertaking, and that therefore the details of management could be attended to to a greater extent than in the case of a larger one. He thought also that undertakings of this size, the shares of which were usually held largely in the town itself, did command a higher value, or at any rate were held in more esteem, than those at a distance. He thought the reasons he had given why he believed the business would grow in Dunfermline, were reasons why they should say the value was high. The fact that electric light had been present for the years succeeding 1894, and yet there had been an increase in gas consumption, pointed, in his opinion, to the fact that there were countervailing circumstances which made the sale of gas increase though the electric light had been introduced. A town where there were a large number of small consumers was a peculiarly favourable field for the introduction of coin-meters. If it were the case that in Dunfermline there were a large number of small consumers, this would confirm him in the view that there was a large field for developments; and even if they were in some cases put in to replace ordinary meters, the revenue would grow with the prepayment meter. He was sure also that there was room for development in the employment of gas for cooking and heating. Keeping this in view, he had no doubt that, whatever might be the future of the electric light, the progress of the gas undertaking would be steady.

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**Monday, Oct. 12.**

The first witness called this morning was,

Mr. *Hubert Pooley*, who said he served his articles as a gas engineer under Mr. Paterson, of Birkenhead. He was appointed Manager of the Dunfermline Gas-Works in April, 1893. By that time the Directors had procured from Mr. Newbigging designs for the new works. A gasholder and workmen's houses had been built on the site some years previously. He superintended the erection of the new works. He had prepared and now produced a plan of the works. In his opinion, they had been put down in accordance with the newest ideas. There was no comparison between them and the old works. In the old works, the retorts were direct-fired; and in the new ones they were fired on the regenerative system. In addition to this, cartage of coal, lime, and other material was saved, the charge for which would be 6d. per ton. He concurred with Mr. Newbigging in what he said regarding the contents of the works and the extent to which they could be increased. He had had an opportunity of seeing the main-pipes at almost every point; and in his view they were practically as good as when they were put in. He attributed this to the stiff blue clay subsoil in which for the most part they were laid. The 18 miles of mains which had been spoken to were all live mains. Since he went to Dunfermline, he had laid, roughly speaking, about 2 miles of mains—chiefly trunk mains of from 18 to 8 inches in diameter. He had relaid old mains where the joints were leaky but the metal perfectly good. They had reached what he considered a low figure with regard to leakage in Dunfermline. The service-pipes were smaller than he would recommend if they were putting down the whole thing again. The principal injury to the Company because of that was due to leakage; they had to send out the gas at a higher pressure than would otherwise be necessary. This came to be a question of leakage too. They used about 3-10ths lower pressure on the south side of the town than they formerly did.

Mr. FOULIS: That may mean anything. Do you refer to the time of maximum consumption?

*Witness:* The pressure at the time of maximum consumption is now 25-10ths; formerly it was 28-10ths. Continuing, witness said he had a record of the illuminating power of the gas supplied during the past three years. The average of the tests approximated 22½ candles.

By Mr. JONES: These were principally his own tests, not Corporation ones. The testing-place was in the works.

Examination continued: Since he came to Scotland, the price of cannel had fallen to some extent, owing to the fact that oil had been largely used for the purpose of enriching gas. Other kinds of coal had also fallen a little in price, but not so much as cannel. He had prepared a statement showing the price paid by the Company for coal last year, which differed from that submitted by Mr. Robertson. He brought out an average of 9s. 9·28d. per ton, whereas Mr. Robertson made it 10s. 7·6d.; the reason being that Mr. Robertson took into view coal which they had in hand at the beginning of the year, and which was dearer. His statement was limited to coal purchased during each of the two last years. The prices for the current year were somewhat lower than for the year 1895-6. They bought all their coal in Fifeshire, getting it from distances varying from 3 to 20 miles. There was plenty of coal in the county. Several new pits were being sunk; and he expected that the output would be larger in the future than it had been in the past. He produced a statement showing the number of new buildings erected since he went to Dunfermline. These numbered 123; and there were 25 now in course of erection. These houses either were, or would be when completed, occupied by 466 families. All the new houses were fitted for gas, and were, he thought, supplied with it. The number of smaller consumers varied a good deal. Tenants of houses renting from £4 to £8 changed frequently in Dunfermline. New tenants who came in for a short time sometimes did not use gas. When trade was bad, they found that the smaller consumers were apt to give up taking a supply. When he was appointed Manager, the Directors resolved to be more strict in enforcing the rule requiring small consumers to make a deposit before obtaining a supply. They found that this affected the number of their consumers; but it had had no influence on the amount of gas sold. The quantity of gas sold in 1894 was abnormally low, owing to the fact that many of the factories curtailed their working hours in such a way that they did not light up morning and night.

By Mr. FOULIS: He had not got a statement showing the proportion which the factories bore to the private consumers.

By Mr. JONES: Those mills which in 1894 were working short time, were now on full time again. What happened in 1894 might occur at any time, with dull trade; but unless the trade of Dunfermline went altogether, it would probably recover.

Examination continued: Last year the total quantity of gas sold to private consumers was slightly less than in the year to May 31, 1893 and he accounted for this by the fact that several of the factories had adopted the electric light. He had prepared a statement showing the quantity of gas consumed in the factories and bleachfields during the past seven years. In the year to May 31, 1893, the factories consumed 13,697,600 cubic feet; while last year they only consumed 11,832,200 cubic feet.

The OVERSMAN: And in 1894, it was 4,500,000 feet.

Examination resumed: This made it evident that, while the consumption in the factories had dimioished, the private consumption generally had largely increased. None of the factories had adopted the electric light during the past two years. A little more than two years ago they put in their first penny-in-the-slot meter; and since then they had fixed 175 of them. He expected the demand for these meters to go on increasing. Since May 31 they had given out about 40 of them; and there had been an increase of about 31 ordinary consumers. They found that the average consumption by the slot meter was much higher than by the same class of consumer with an ordinary meter. They had one instance of a man whose supply was cut off because he would not pay his gas account, amounting to about 15s.; and last year he paid them 69s. 9d. by the penny-in-the-slot system.

Mr. JONES: You think they burn more boldly because they know what they are limiting their liability to?

*Witness:* That is exactly my idea; they are more free in the use of the gas, because they know they have no accounts coming in.

By Mr. FOULIS: They charged these consumers at the rate of about 4s. 7d. per 1000 feet; but this covered meter-hire, and they put in fittings if necessary.

Examination continued: Hitherto they had not particularly pushed the sale of gas for cooking and other purposes; but now their new works would easily enable them to do so, and he had no doubt that increased business would result therefrom. His opinion, from his knowledge of Dunfermline, was that the business of the Company would increase. There was a large number of people kept on their books at one time who were really not consumers. In the year 1892-3, they had 246 customers on their books who consumed only about 263,000 cubic feet among them—giving an average of a little more than 1000 cubic feet each. None of these people took gas now; they had either all been cut off or had left the town. They were just the class who would get on very well with the prepayment meter system. Their present number of consumers was 3881; being 30 more than at the date of the last balance. There was a sum of £467 17s. 11d. spent on meters during the year to May 31, 1896, which was charged to the machinery and capital expenditure. This sum included £139 expended in the purchase of new slot meters; £118 expended on 97 new meters, put into properties where there had been none before; and £209 expended on meters which for the most part replaced old ones. It was the practice some years ago for the Company to do the work of repairing meters by their own men, but not to any extent during his time. The Directors had practically given him a free hand as to buying coal. Speaking generally, he had been buying the same sorts all the time he had been there. It was part of his duty to assist in framing the annual balance-sheet of the Company. For this purpose, he took all the stocks of materials, and valued them at the prices of the day, according to the best of his judgment; and he also made up an estimate of the quantity of gas sent out since the meters were last read. The entries in the balance-sheet to May 31, 1896, were prepared and verified by him in the usual way.

Cross-examined: He did not think there was a material increase in their labour bill. There was an increase per ton, but a decrease per 1000 cubic feet. This was accounted for by their using less coal, and still having the same labour. The condition of the main pipes, which were laid half a century ago, was certainly as good as if they were new, where he had seen them. The town lay on a sloping rise to the northward from the gas-works. They had not reduced the pressure in all that portion, which was the main body of the town; the 3-10ths reduction of which he had spoken, applied only to a small section of the town. The new site was, roughly, 70 feet lower than the former one. They had two governors in the old works—one for the north side and the other for the south; but they had only one governor now. He had not had many complaints as to illuminating power; and those he had had were chiefly from small consumers. Occasionally he had complaints from factories; the reason being that their meters were too small. In the year ending May 31, 1896, they had some coal from a greater distance than 20 miles away—from Yorkshire. The 20 miles applied to Methil and Muiredge; but they had a very small proportion from there. The next furthest away was Lochore and Capledrae, about 15 miles; and from there they obtained a large proportion. Last year they got most of their first-class cannel from the Lochore district. The splint and second-class cannel they obtained from the Cowdenbeath and Townhill districts. Townhill was about 7 miles by rail. They could not get splint of poor quality near at hand. He had not heard that two of the linen factories were about to increase their electric light installations. These two factories paid about £800 a year for gas; and the two co-operative societies paid about £600 a year for gas. He was not aware that at the present moment electrical engineers were preparing plans for the supply of electric light to the society. Of the £467 for new meters, £257 represented meters for new consumers, of which £139 was for new slot meters, and £118 was spent on 97 meters put into new property.

By Mr. FOULIS: They had none of these slot meters in stock now. They might have had some at May 31.

Mr. SHAW: Do you see that in the year 1895-6, though you incurred a capital expenditure in supplying meters for 157 new customers, you only increased your customers by 40?

*Witness:* The difference is accounted for by removals, by deaths, and by parties being cut off for arrears. The net increase was 40.

The OVERSMAN: I would like to know what proportion the number of present consumers bears to the number of possible ones?

*Witness:* I cannot give the total number of ratepayers; but I think there is a large field.

The OVERSMAN: May I be permitted to make one remark. It is sometimes suggested in these cases that the Corporation are buying a good thing because, among other reasons, there is a large field for an

increased supply of gas; and that is attempted to be proved in this way: It is said the number of possible gas consumers is 10,000, and that the number actually taking gas is 3000; therefore there is a margin of 7000 to come upon. But the bulk of this 7000 might consist of very small householders, who were not at all likely to take gas; and therefore the argument is very weak, if it turns out that the increase is in houses of that sort.

Mr. ASHER: Is your point not met by this—that in Scotland gas is introduced into every house. It is not a question of houses that have not the means of burning gas; it is really a question of the actual burning of gas. In all burghs where there is a gas supply every house which is built is provided with gas-fittings; and it is only when the gas is taken that a meter is put in.

The OVERSMAN: I do not think that quite answers what I mean. The reason why they do not consume gas is probably that they are very small householders; and even in these cases we find the slot meter being put in—I assume with houses where there is every convenience for the ordinary meter.

In further cross-examination, witness said that the reason why the number of meters exceeded the number of consumers was partly that they had cut off so many persons who had meters because they did not pay for the gas they were getting. Another reason was that when a family removed from a house, sometimes the new tenant did not take a supply of gas. This applied to small consumers.

Mr. FOULIS: We had it from Mr. Newbigging that there were 3900 meters belonging to the Company, and 400 belonging to private consumers. How is this discrepancy accounted for?

*Witness:* Partly by the stocks on hand, and partly by meters lying idle in houses. In some cases there is more than one meter on the premises—in factories, and also in houses.

That would leave you with something like 500 meters, either in stock or with consumers, that are not on the list?—Yes. There would be some 120 or 130 meters at the works.

Why did you buy new meters if you had 130 lying at the works?—Because in all cases I did not consider the meters fit to go into the houses. Some of them were wet meters; and the pressure being high, I have been putting in a good many dry ones.

Mr. SHAW: We have got it now. That is permanent old stock?

*Witness:* A great many of these meters were fit to go into use. Continuing, he said that he was a member of the North British Association of Gas Managers. The information regarding Dunfermline given in the statistical report on the gas supply of Scotland contained in the Proceedings of the Association for 1894, would be furnished from their office most likely. The price of gas being given at 3s. 2½d. was a misprint; it was stated to the parties who printed the book at 3s. 7d., and the discounts were named. He thought the discounts to the town made the price for the public lamps about 3s. 2½d. He could not say how the mistake arose. He thought that they would find it corrected next year.

Re-examined: He gave no authority for making an entry that the price of gas to ordinary consumers was 3s. 2½d. per 1000 feet. He should say that about half of the meters on hand were not worth much more than old metal; but the other half were quite fit to be put in. All of them would not need repair. The maximum quantity of gas they made in any one day in 1895-6 was 454,000 cubic feet; but all this was not necessary. The daily average of the maximum week was 402,000 cubic feet. The minimum make was 46,000 cubic feet. The explanation of the very large make on one day was that they had allowed their stock of gas to run too low.

By Mr. JONES: The mills continued to burn gas—even those which had taken the electric light. In the case of one, he believed, they had had several failures with the electric light. With regard to the great fall in 1893-4, he thought that the loss of these large consumers merely put the hands of the clock back.

By Mr. FOULIS: In 1893-4, their leakage was 10,400,000 cubic feet; and in 1895-6, it was 5,500,000 feet. During this period the old works were abandoned, and there had been increased vigilance on the streets, which tended to reduce leakage. Besides this, they had renewed several mains and services. They practically made 22½-candle gas.

Mr. FOULIS: That is not the usual quality of gas in Scotland?

*Witness:* I think it is higher than in Glasgow. I believe you and I are the only two people in Scotland who supply such a quality.

I consider you are very wise; but what I was going to suggest was that in comparing the price of gas in Dunfermline with the price in other towns supplied with (we shall say nominally) a higher quality of gas, it would be fair to take that into consideration?—The cost of supplying a higher grade of gas is greater. In a town where the gas is of higher quality, the price should be more.

And as we have had comparisons put in as to the price of gas in Dunfermline and in other towns, unless the quality of the gas were taken into account, the comparisons would be entirely misleading?—A good deal depends on other circumstances too.

Mr. *Adam MacPherson* said he was an Engineer, and had been for 26 years Manager of the Kirkcaldy Gas Company. His experience in connection with gas-works extended over 30 years. He was acquainted with Dunfermline and neighbourhood; and he knew the old works of the Company. He had visited the town and inspected the site of the new works, and also the manufacturing plant. Comparing the site with that of most medium-sized gas-works in Scotland, he should say it was exceptionally good, because there were few such works which had railway connection. He also agreed that the site was capable of producing a much greater quantity of gas than was made there at present. As to the works themselves, he found them to be of the most modern and improved description, in excellent order and condition—in fact, new works. The capacity per mouthpiece was given at 8300 cubic feet; but he thought they should turn out 10,000 feet each, which would make a total for the works of 640,000 cubic feet, per 24 hours. He would allow 12½ per cent. for reserve power. This would make the producing capacity of the works 560,000 cubic feet per 24 hours, or 25 per cent. in excess of the largest quantity ever produced. If a better class of coal were used, he thought the quantity of 10,000 cubic feet per mouthpiece could be considerably increased. He could produce more than 11,000 cubic feet at Kirkcaldy. By extending the works, he believed that the producing capacity could be quadrupled on the site. The new retorts which had been introduced were, in his opinion, superior to the old. A considerable saving in fuel was effected by the regenerative system; and there would be less expense in maintenance. The maintenance of the retorts in Dunfermline would not cost so much as would be the case in England. They required fewer retorts to produce the same quantity of gas, and consequently they had less renewals. He also had in view the fact that wages in Scotland were lower than in England. The capacity of the holders was considerably greater than was usual in works of this size. There were few works in Scotland in which the boiler and exhauster were duplicated. He did not think it was necessary in constructing new works to have them duplicated; they could only go wrong for a very short period. With regard to the Walker washer, he had used one of these for a good many years; and he never wished to have a more efficient apparatus.

Mr. FOULIS: I quite agree with you; and I have used them also.

*Witness* (continuing) said that he did not think it would have been at all desirable to have had six retorts in a setting instead of eight, because naturally the engineer constructing the works would look forward to an increase in the production; and he did not consider that there was any loss by putting in settings of eights. They could regulate their draught to suit according to whether they had to run in a little larger or a little lighter charge; and having eight retorts in the setting would make no appreciable difference in the cost. The minimum consumption for a weekday was about 60,000 cubic feet, which very nearly approached the product of one oven. A single oven was capable of producing 66,400 cubic feet per day. The production could be easily regulated so as to meet the requirements.

Mr. JONES: Is it the Scotch practice to suspend working some time on Sundays?

*Witness:* Occasionally we allow the retorts to lie off in summer, but not in winter. Continuing, witness said that he inspected 109 of the meters in the town. He got the meter register and selected a large number of the oldest for inspection, along with a few of the more modern ones, and especially the tin-case dry meters. He found them all in an excellent state of preservation. He inspected 21 dry meters, 19 of which were in tin cases, and 2 in cast-iron. The remaining 88 were wet meters, which largely predominated in Dunfermline.

Mr. FOULIS: When you say that you inspected them, do you mean that you went and looked at the outside?

*Witness:* Yes, an external inspection; and I compared the indices with the last reading, to see that they were recording rightly, and that none of them were standing.

I would not like to call that an inspection of meters?—It was the only inspection I could make.

I agree with you?—Then you could not ask me to do an impossibility.

By Mr. JONES: He got the Surveyor to take him to the places where they were, and to show them to him. Some of the meters he saw were, he should say, 30 years old.

By Mr. FOULIS: Some had been stamped and some had not; but that was immaterial, because they had not adopted the Act.

Examination continued: He did his best to make a fair selection, with a view to a satisfactory examination. He selected what he thought would be in the worst possible condition, looking to the age. It had been pointed out that there had been a decrease in the consumption of gas in Dunfermline in 1894, as compared with 1893, of about 9½ million cubic feet; but this was a very general experience. He had prepared a table giving the consumption in different towns in Scotland in that year. This showed the following decreases: Brechin, 11·8; Dysart (linen manufacturing town), 15·7; Forfar (linen manufacturing town), 10·7; Galashiels (tweed manufacturing town), 13·6; Maybole (shoemaking town), 25·5; Renfrew, 11·3; and Dunfermline, 14·3. There was a very general depression in trade all over the country at that time. Even in Glasgow, where they had an increase of 120 million cubic feet the year before, there was a slight decrease. He obtained his figures from the North British Association's return and Field's "Analysis." The North British Association's return was official so far as the Association was concerned. A form was sent out by the Secretary, with a request that it be filled in; and only such members as made returns were supplied with the statistics.

Mr. JONES: But you do not claim that these returns have the authority of the Board of Trade returns, for instance?

*Witness:* No, except for Glasgow.

There is no compulsion on anyone to give you the figures, or to be careful what they tell you?—No; but we trust to their honour that they will give us a correct return, as members of the Association. I think we may take for granted that they are accurate.

The OVERSMAN: You may take it with a very large grain of salt, because we do not know whether the figures are correct; and consequently we do not know in individual instances to what the decrease is due. We must take it *quantum valeat.*

Mr. FOULIS: There is another thing. Unaccounted-for gas varies from year to year, and it upsets all the calculations.

*Witness:* Very slightly, as you know.

The OVERSMAN: It is an attempt to come as near as you can; but we must exercise our judgment.

Examination continued: He understood that the trade of Dunfermline was improving; and he expected that it would go on increasing. He should think there was a field for the development of the consumption of gas in the adoption of the prepayment meter in Dunfermline, from the fact that there was a large number of miners resident in Townhill, who would take gas, he believed, by this method of supply, but who would not take it by the ordinary way. It was among this class that he would expect the coin meter to have the greatest field, and also among the migratory class. A development might also be looked for by the adoption of the incandescent burner. He had no hesitation in saying that he thought it would soon cut out the electric light, because it was so much cheaper. An increased consumption might also be looked for by the adoption of gas for cooking and heating, and also for gas-engines. The price—3s. 7d. per 1000 cubic feet—seemed to him, taking the circumstances into consideration, to be a fair one. He had prepared and submitted a list of towns in Scotland, with a population ranging from 10,000 to 40,000, with the price of gas attached.

By Mr. JONES: He should say that very generally the quality of gas throughout Scotland would range from 24 to 26 candles, with the exception of Glasgow—and Dunfermline, evidently. This table brought out an average of 3s. 7½d. per 1000 cubic feet for gas ranging from 24 to 26 candles.

Mr. SHAW: He has Kirkcaldy in his table at 3s. 1½d. Would you ask if that is the price in Kirkcaldy?

*Witness:* It was for the year 1896 that I was giving the price.

What is the price in Kirkcaldy now?—2s. 11d.

Examination resumed: The prices given in his list were those charged for the year which corresponded with that ending in May, 1896, at Dunfermline. If £12,000 were expended on the works, the manufacture of gas could be increased to 135 million cubic feet per annum. This would leave space for further extensions at a similar moderate cost. If £12,000 were expended on extending the works, the capital and fixed plant account would be raised to £75,000, which would work out at £555 per million cubic feet. This was, in his opinion, a low capital. As it stood at present, the capital was rather higher than usual. The great disparity between the maximum and minimum daily consumption tended to raise the capital expenditure. Wherever the maximum and minimum were so far apart as they were in this case, the capital expenditure was necessarily larger, because they required works to supply the greatest demand, and when the consumption was low, their plant was to a certain extent non-productive. The minimum was about one-tenth of the maximum. In this view, it would be an advantage to have a large number of small consumers, because they would thereby increase the summer consumption. It was on the small consumers that they relied almost exclusively to bring the plant more into use. In order to arrive at the commercial value of the works, he took the profits for the year ending May 31, 1896; and, in his opinion, this was the only year it would be fair to take. He started with the initial figures as brought out in the accounts—£5232. On the accounts for the year he required, however, to make a correction. He found that the expenditure on repairs, renewals, and maintenance of works, plant, mains, and meters was too small; and he added 1·71d.—bringing it up to about 4½d. per 1000 cubic feet sold. The figures standing in the accounts was 2·79d. He considered that 4½d. would be a fair average for Dunfermline; and this would be equal to £417. To that he added transfer fees, making it £420. Deducting this amount from the £5232, left a net profit of £4812. The difference between his valuation and the others was that he did not deduct the interest on mortgages; he had taken it for granted that the Company would settle the mortgages. Taking the figure of £4812, at 26¾ years' purchase it amounted to £128,320. Adding £12,832 for compulsory sale, £6000 for surplus plant, and £1283, or 1 per cent., for winding-up expenses, the total was £148,435. This was exclusive of undivided profits, stock-in-trade, book debts, or balance at credit of reserve fund. He considered this was the sum which ought to be paid for the undertaking, exclusive of the items he had mentioned, and the Company discharging the mortgage debt. If the Corporation discharged the mortgage debt, the amount would be correspondingly reduced.

Mr. JONES: Including 10 per cent. on the purchase money?

*Witness:* Of course, you must deduct the 10 per cent. too.

Examination continued: In reaching this figure, he was keeping in view that the Company was a non-statutory one, and not in any way bound in regard to the price of gas or as to dividend. He proceeded on the footing that the Company should be compensated for the income they were being deprived of, by giving them as good an income and security. The Company spent money in building new works, with the object of increasing the profits. This object had been attained; and consequently he considered 1896 was the only fair year to take. He believed the profit would be maintained. In his opinion, the Dunfermline Gas Company was a first-class security; and every year they were finding more difficulty in getting such securities. It was equal to a 3¾ per cent. investment. The shares were £5 nominal and paid 7½ per cent.; and they were now selling at £10 2s. 6d. while some had been sold as high as £10 10s. 6d. They were a favourite local investment; and he saw no reason to doubt that the class of investors in Dunfermline would be different from those in Kirkcaldy. He was acquainted with the state of the coal trade in Fife. He could not see any probability of a rise in the price of cannel coal generally. They knew very well that splint coal was a drug in the market, and cannel could not rise. If they were to put anything on the price, gas managers would immediately adopt the Peebles oil process and leave cannel alone.

By Mr. FOULIS: He did not think it was the case that cannel was very scarce and getting scarcer; they could get any quantity in Fife, if they wanted it. He supposed there were hundreds of acres of cannel at Methil untouched yet.

Mr. JONES: As a matter of fact, before the introduction of oil—whether light or heavy—we had great difficulty in getting cannel in the south?

*Witness:* Yes; but it would be caking cannel you would use.

No?—Well, we never had any difficulty in obtaining cannel. There is any amount of it to be had; and immediately they attempt to raise the price, we adopt oil. There is only a very little difference between the two; so that we have an effectual check on the rise of the price of cannel.

Cross-examined by Mr. SHAW: In Kirkcaldy, they had the boiler and exhauster duplicated; but theirs was a much larger place than Dunfermline. He did not agree with Mr. Newbigging when he said that all the mains of less than 3 or 4 inches ought to be relaid. The smallest mains he would lay would be 1½ inches in diameter. He could not say off-hand what extent of 1½-inch mains they had in Kirkcaldy; but it was considerable. They had laid a few of this size within recent years, but not many—certainly not half a mile. The life of a meter was practically unlimited, if it were repaired and allowance made in the accounts for repairs and renewals. He was referring to wet meters. He did not get the ages of the meters further back than 1860.

Mr. FOULIS: So far as I am concerned, this line of examination need not be carried further, because a mere examination of the outside of a meter is, to my mind, of no value at all. If one of the workmen took a wet cloth beforehand, and wiped the meter, it would look like new; and an external inspection under such circumstances is of no use.

By Mr. JONES: The bulk of the meters were wet. He said that a wet meter had an unlimited life if they repaired the parts as they fell in. The period between 1860-96 would have extinguished a dry meter twice over. This was why he did not allow so much as was customary in English works, which was 5d. Their wet meters had all cast-iron cases, which lasted much longer than tin. Whatever the condition of the meters, they had realized profits, with a loss of only 8½ per cent., which showed that they had been registering correctly.

Cross-examination continued: Kirkcaldy was not in his list of decreases, because there was an increase there. Dunfermline was third on his list, which he believed was owing to depression in the linen trade. There were linen factories in Kirkcaldy, but nothing compared to Dunfermline. In Kirkcaldy, they had the floorcloth industry, which had been flourishing for years. It was an advantage to a town to have a variety of trades. A place like Dunfermline, which depended mainly on one industry, was more liable to fluctuations of the extensive kind which was experienced in 1894. The decrease in that year took place chiefly in towns where there were manufactures; residential places would be different. The list he had produced referred chiefly to towns where there was a linen industry. He knew that there had been a growth in the linen trade in Kirkcaldy during the last year or two. They had very little experience of the prepayment meter system in Kirkcaldy; they had not the class of consumers for it. In Dunfermline, there was a large number of miners. There was a migratory class generally where they had factories; and they could not get people of this class to take gas unless they gave them it in pennyworths. Assuming that the conditions remained the same, after the cost of the removal of the works had been met, he had no doubt they might be able to reduce the price of gas 2d. or 3d. per 1000 cubic feet. He thought that a dividend of 10 per cent. was maintainable, because if not they would have seen a falling off in the consumption. If they kept up an inflated price, consumers would soon drop off; whereas here there was an increase. He did not think there was any fear of competition in Dunfermline. Any competition that had been attempted in Scotland had ended in the two companies combining and recouping themselves for what they could not get in opposition. It meant, in the first instance, a reduction in the price of gas; but then they immediately put it up, and recouped themselves for the dividends they did not get before. This was the history of competition in Scotland. He considered 22½-candle gas a fair quality, though he preferred it higher. He was not prepared to go the length of saying that 22½-candle gas was a very poor article to supply for 3s. 7d.; he thought it was reasonable enough. If he were managing the works at Dunfermline, he might see very sufficient reasons for charging this price. In Kirkcaldy, the price of gas in the year he was comparing Dunfermline with was 3s. 1½d., and this year it was 2s. 11d.; but they allowed no discount. It was no doubt cheaper than in Dunfermline; but he did not think that a comparison could be made. For instance, they knew that the larger the manufacture and output, the cheaper they could make it; and this was a considerable advantage. Then, as he had said, they had not yet got a fair trial of the new works at Dunfermline.

By Mr. FOULIS: He thought there could be considerable economy in the carbonizing department—making the retorts yield a larger production, and thereby saving tear and wear and wages. The Manager also would come to get a better grasp of the works from experience of them, and would be able to reduce on various items. He might be able to see little things where economies might be made. He did not know of anything else in particular to account for the difference between 2s. 11d. and 3s. 7d. The manufacture of gas in Kirkcaldy for the year ending May, 1896, was 89,913,300 cubic feet; and in Dunfermline it was 65,187,000 cubic feet. The Kirkcaldy district was considerably more scattered than that supplied by the Dunfermline Gas Company. This was a disadvantage in the case of Kirkcaldy. The consumption per mile of mains in Kirkcaldy was 2,140,000 cubic feet; and in Dunfermline it was 3,500,000 cubic feet. This also was in favour of Dunfermline, and against Kirkcaldy. The percentage of unaccounted-for gas in Dunfermline was 8·59 last year; in Kirkcaldy it was 10·9—again to the disadvantage of Kirkcaldy. The works at Kirkcaldy were at a considerable distance from the railway, which was a further disadvantage to Kirkcaldy.

Mr. FOULIS: Are not all these things amply sufficient to overcome the advantages that Kirkcaldy may derive from the fact of its greater sales?

*Witness:* No, I would not say so.

You supply gas in Kirkcaldy which is superior by 3 or 4 candles to that furnished in Dunfermline. What will it cost per 1000 cubic feet to produce the difference?—I cannot tell you right away. I consider 3d. per 1000 cubic feet would be an excessive figure. The difference is 2½ to 3 candles; and I think 2d. would be amply sufficient. The cartage at Kirkcaldy would add not 1d. per 1000 cubic feet to the cost; ¾d. would be more like it.

Is that 3d., 4d., or 5d. per 1000 cubic feet not amply sufficient to overcome the advantage which Kirkcaldy has in the greater number of consumers?—It should help it, at least; but I do not know all the circumstances, perhaps, which militate against them working so economically as I can.

Do you see any reason why, if with all these disadvantages in Kirkcaldy you can supply gas for 2s. 11d., it should not be done in Dunfermline?—Of course, they have a greater capital than we have.

By Mr. JONES: The capital of the Kirkcaldy Company was £42,000—rather over £500 per million. Their share capital was £36,000; but £42,000 had been expended on the works. It cost 9d. and a fraction per 1000 cubic feet to pay a dividend.

Cross-examination continued: There had been a considerable fall in the price of gas in recent years, since the introduction of the Peebles oil process. In Kirkcaldy, the fall had been from 3s. 6½d. in 1891-2 to 2s. 11d. at present. A fall had occurred more or less all over the country. In Dunfermline, the price had remained steady. He would not say that was very exceptional. If they needed it to pay dividend they required to keep up the price, as long as it was not excessive. He made up his valuation before he knew that the Corporation were to take the mortgages. In reaching the conclusion that 26¾ years should be the basis of purchase, he spoke for himself; he did not concur with anybody. He used his own judgment; and his judgment and

experience led him to the conclusion he had come to. In his Company, they had no arrangement with the town; but as a number of the large consumers were also shareholders, they had a regulation in the Company that the dividend should not be more than 7½ per cent., because they would be taking it out of one pocket and putting it into another if they paid large dividends. If in any year they had more money available than was necessary to pay a dividend of the maximum amount, they sometimes put it to depreciation, sometimes to reserve fund, and sometimes to both. Those were certainly both funds that went to make up the stability of a concern; and their Company was accordingly the more stable because it had got them. This was no doubt one thing which made the value of the Kirkcaldy shares in the market likely to be higher and better regarded than Dunfermline shares; but he did not see why, in the course of a few years, Dunfermline should not be as well off with regard to a reserve fund, &c. He had changed his opinion recently about the number of years' purchase. In the Falkirk case, he put it in at a lower rate; but then the Kirkcaldy shares were selling at £9 2s. 6d., whereas they were now up to £10 2s. 6d.—a very substantial rise—and he had therefore good ground for changing his opinion. It was not solely because the price of the Kirkcaldy shares had gone up, he had changed his opinion. If they looked at any of the gas companies, they would find that there had been a material alteration. In the case of the London Companies, they would find a very material increase in price.

Mr. SHAW: At the time you gave evidence in the Falkirk case, had you abandoned the idea of there being any difference between a statutory and a non-statutory company?

*Witness:* I have always said there is a slight difference, but not a very material one. I should say now there is not a difference of above two or three years' purchase. I think the difference is simply precedent; and, in my opinion, the sooner it is abandoned the better.

Did you ever hear of any case prior to this in which the difference was not recognized?—It is difficult to know whether it is recognized or not, for you never get a detailed decreet-arbitral, and you have no way of judging.

Mr. FOULIS: You can always calculate it?

*Witness:* Well, if we were to take the calculations of some of the witnesses in the Falkirk case, the award would work out at about 36 years' purchase. I think that Mr. Hunt's calculation of the maintainable profit, as compared with the award, would work out at about 35 or 36 years' purchase; and there were other witnesses very much the same. They said that about 21 years' purchase, or something like that, was the thing; and at their valuation the award, taken in connection with the maintainable profit, would have worked out to 36 years' purchase. Continuing, witness said that his multiplier in the Falkirk case was 23½ years' purchase; but the circumstances had altered since then, and they could not now buy shares as cheaply as they could then. In the Falkirk case, his valuation was £115,276 odd. The total amount given there was £77,000; but in his opinion the works were simply thrown away.

Re-examined: In the comparison of Dunfermline with Kirkcaldy, there were some counterbalancing advantages in Kirkcaldy. They took more gas out of the coal. In Kirkcaldy they were still going on in the original works, which were established in 1830, and which had been merely extended since then. He would certainly not consider it fair to compare the conditions of output at Dunfermline, where they had recently moved, with those at Kirkcaldy, where they had been established so long. That would be especially applicable to the carbonizing power of the retorts. They required to have their works in thorough going order before they could develop the retorts to their full capacity, and understand the working of them. He knew the difficulty he had for the first year or two, until he got his men to understand the working of the regenerative system; and that was everybody's experience. He thought it would be possible at Dunfermline to provide gas of the same illuminating power as at Kirkcaldy, and yet to maintain the same profit. Of course, by using high-class cannel they got coke; but that was a secondary product, and he thought it was dear at the money. He got the same illuminating power out of shale at 13s. per ton as he could get out of high-class cannel which would cost 21s. 4d. per ton at Kirkcaldy.

By Mr. JONES: A certain amount of the fall in price at Kirkcaldy was attributable to the drop in the price of coal; but a very material amount of it was due to the increased output of gas. A great number of their charges remained stationary; and their surplus works were coming into use, and would go on in this way till they required further extensions. To put it in another way, capital which was not before fruitful became so by the extension of their business. On gas being sold in larger quantity, the dividend became a smaller charge upon it. He thought that the same results would work out in Dunfermline as had done in Kirkcaldy, and that they would be able to reduce the charge if they got the increased business.

Mr. FOULIS: And if they do not get the increased business, what will be the result?

*Witness:* That is the purchasers' risk; and they knew the risk before they gave notice of the adoption of the Act. The Company were not offering to sell; they were forced to it.

Where you have two towns alongside of each other—as Dunfermline and Kirkcaldy—the one practically equally well situated for coal as the other, and one supplying 22-candle gas while the other supplies 25-candle gas, do you think it is fair to consumers, altogether apart from the Company, that the lower quality gas should be supplied at the same price as the higher quality?—No, relatively, certainly not.

Much less is it fair to them that it should be supplied at a greater price?—That depends upon circumstances. I do not admit that.

Mr. *R. E. Walker* said he had been Provost of Dunfermline for about two years. In the autumn of 1895, the question was before the citizens of whether they would adopt the Gas Act for the purpose of enabling them to acquire the Company's undertaking. It was first mentioned in July, 1895. He was particularly anxious that all the information he could communicate to the citizens should be in their possession before the autumn election of the Council. He made all the inquiries he possibly could, so as to enable him to advise the citizens what they should do. A public meeting was convened for the purpose of giving him an opportunity of announcing what information he had obtained, and what advice he wished to give them in the matter. In considering whether he would recommend the purchase of the works or not, he applied his mind to the possible effect of electric light on the gas-works; and he put himself in communication with a number of towns where the electric light had been introduced. He obtained information from Portsmouth, Manchester, Aberdeen, Bradford, and Glasgow. He was certain that the consumption of gas would be decreased in Dunfermline by the electric light; but he thought it was a mistake to suppose that the electric light would be introduced into workmen's houses, and that therefore it was better to keep the gas as the public light. He was in favour of acquiring the gas undertaking. He had personal experience of the effect of introducing electric light into his works. His opinion was that if no extension of the electric light took place, and if the gas-works were obtained at a reasonable price, they would be profitable to the town. The notice to purchase was given in March, 1896; but they had adopted the Act before then.

Cross-examined: By the year 1890, there was considerable dissatisfaction in regard, not only to the quality, but the price of gas. The Town Council took it up, having previously had an agreement with the Company. In his own case, it was no mere matter of rumour, as he himself was a victim. That was particularly as to the quality and disagreeable character of the gas. It was sometimes so bad that they had to shut off altogether, and allow the people to get out. The Company declined to come under any pledge to keep the price as before. After that the dissatisfaction continued; and, in consequence, in 1895 the matter was introduced at the Council Board. The Company declined to confer with them as to the quality and price of gas; and the Council were driven to do what they did in the way of proposing to take over the works. If the Company had consented to be bound to continue the terms of the arrangement, which had lasted for a quarter of a century, he could most emphatically say that these present proceedings would never have been taken. Townhill was a part of the burgh though it lay some distance away. It was lighted by gas. It was inhabited by colliers; and as the coal was getting wrought out, there was the prospect of the gas consumption there being lost.

By Mr. FOULIS: Speaking from his own experience, electricity cost them about a half more than gas.

Cross-examination continued: Dunfermline was a single trade town. He was told that there were no fewer than 5500 people employed in linen factories and bleachfields in the town. One serious drawback was that, when the coal was exhausted, they would be short of workers, because people would go away. There were already, he believed, 800 or 1000 looms standing idle because of the want of workers. He was in fear there might be a fall in the Dunfermline linen industry; and there certainly could be no extension of it.

Re-examined: He had a very poor opinion of the prospect of Dunfermline. Belfast had been a growing competitor every year for some time past; and he certainly put that forward as a danger affecting the price of the gas-works.

Mr. *G. Dick* said he was a builder in Dunfermline. He produced a list prepared by him of new buildings erected during the past three years. The number built was 123; and another 25 were in course of erection. The new families numbered 364; and the number of families to be provided for by the houses under construction made 102. Four-fifths of the buildings had been erected on new sites. He did not think there was any likelihood in the immediate future of the mining population in Townhill ceasing to find employment in the vicinity.

Cross-examined: There were some unoccupied houses in Dunfermline; but he could not say how many. He believed that during the past few years there had been an increasing number of old houses unoccupied.

Mr. *D. Alexander* said he was Chairman of Messrs. J. and T. Alexander, Limited, manufacturers, of Dunfermline. He was elected a Director of the Gas Company in 1883; and he had been in office since with the exception of from 1886 to 1889. Since 1891, he had been Chairman of the Company. The Company was initiated in 1828, at a meeting of the inhabitants of the town. He handed in the minutes of the Company, and the agreements with the town. He was Chairman when the Company decided to abandon the old works. Their Manager (Mr. Mackenzie) warned them that they were working at a considerable risk, and that he could not advise them to press the production at that time any further than was absolutely necessary. They were consequently aware that they were not furnishing the supply they desired to give; and the Directors were so impressed with their responsibility, that they resolved to call in Mr. Newbigging. The result of his advice was that they abandoned the old works and built the new ones. When they put up the new works, they anticipated that it would be a highly advantageous move as regarded the Company. They had it quite in view that they had the means then of giving a largely increased supply, and of making gas under more economical conditions. They also had it in contemplation to push their business in a way which they could not have done before. After the town adopted the Act, they were in a position to compete with the Company, with the rates at their back. The Directors realized that this was a state of matters which would necessarily overwhelm them; and it appeared to them to be a case of being destroyed or agreeing to sell. They had no wish to sell, but desired to get the full good for the future of the works which they had erected. The Directors had a confident expectation that they would be able in their new works, by judicious management, not only to make a handsome profit, but to reduce the price of the gas. They had been advised by Mr. Newbigging and others that that might be so. The trade of the town was largely with the United States; and it was the M'Kinley Bill which produced such a disastrous state of matters in 1893. He did not think that such a state of affairs had ever occurred in Dunfermline to affect the Gas Company, unless at a period of the War of Secession in 1862. They had not adopted the electric light at their works, and had no intention of doing so. He understood that the electric light had not been at all profitable to those who had introduced it. He did not consider there would be any further development of the light in factories—at any rate, to any great extent. He felt confident that the demand for gas in Dunfermline would expand.

Cross-examined: He had been a shareholder of the Company since 1871. He paid for the first of his shares, on allotment to a relative, at

the rate of £17 10s. for £10 shares. At that date the shares were raised to £17 10s.; and an additional number of shares were issued. He held 62 shares.

Mr. SHAW: Is it the case that in 1892 310½ shares were issued at £1 premium—that is £26?

*Witness:* I know there was an issue at £1 premium.

In 1893, were 148 shares issued at £1 premium?—They were all issued to existing shareholders; and no one else had an opportunity of obtaining them. If you say that in July, 1894, there were 100 shares, issued at £27 a share, I have no doubt that is correct.

Are you aware that sales were also effected in August and September, 1895?—I know that transfers were taking place constantly at about that price; but I cannot speak to a specific date. The prices contained in the last transfers presented to the Company were from £29 to £31; but I cannot say that those were the prices paid in the open market. Witness went on to say that if he had been offered £45 each, he believed he would have entertained some idea of parting with some of his shares. He certainly considered that their claim of £132,000 was a just one, though it would yield them £65 11s. on their shares. His reason for that was that he could not get investments for his money.

Mr. JONES: Supposing you were to get a net income, after paying all charges on borrowed money, of £47,000 a year. As an ordinary investor, if you could get such an income, do you think it would be much out of the way to give £130,000 for it?

*Witness:* I do not think so.

Mr. *Ross*, Solicitor, of Dunfermline, said he had made an excerpt of all the transfers of shares recorded in the books of the Company since Jan. 1, 1893. There were altogether 2013½ shares; and of these 1047 were held by persons in Dunfermline. There were 282½ shares held by trustees and corporations.

Cross-examined: Some of the shareholders sold portions of their holdings, justly expecting that they might make a profit by selling them. When the last sale of shares took place at £31, in April last, it had been quite resolved that the Company should sell.

This closed the case for the Company.

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**Monte Video Water-Works Company, Limited.**—The Directors of this Company have declared an interim dividend at the rate of 5 per cent. per annum for the half year ending June 30 last.

**Gas-Works Extensions at Nelson.**—The Nelson Corporation have resolved to expend £40,000 in developing their gas-works, putting down machinery, and laying new mains in the borough, Brinfield, and Barrowford. Application to borrow the money is to be made to the Local Government Board.

**Water-Works Improvements at Morpeth.**—The Morpeth Town Council have secured the sanction of the Local Government Board to the borrowing of £4500 for the purpose of improving the water supply. A meeting of the ratepayers last Tuesday passed a resolution in which they respectfully asked the Council to expend only such portion of the money sanctioned as would enable the town to get the full benefit of the excellent water obtainable from the springs at Tranwell, and place the present reservoir in a thorough state of repair.

**Additional Capital for the Budleigh Salterton Gas Company.**—Owing to the increasing demand for gas, and the probability of a still larger requirement on the opening of the new railway which is being made to the town, the Budleigh Salterton Gas Company have decided to enlarge their capital. As originally constituted, it stood at £3000 in £5 shares. It is necessary now to thoroughly overhaul the works, lay larger mains, and renew some of the services. At a special meeting called for the purpose on the 15th inst., the shareholders formally authorized the Directors to take the necessary steps to raise £5000 of additional capital. They were also empowered to make provision for the supply of electricity; and the name of the Company will, in that event, be altered to the Budleigh Salterton Gas and Electric Lighting Company, Limited.

**Incandescent Gas Lighting at Teddington.**—At a recent meeting of the Teddington District Council, it was stated that the Gas Company had offered to furnish for public lighting incandescent burners fixed complete for 15s. 6d. each, and further to supply gas, provide all necessary new lanterns, execute all repairs, alterations of present lanterns, and maintain burners, mantles, glasses, and lanterns in good condition, including the painting of lanterns and all work as at present connected with the lighting of the district—for £3 15s. per lamp per annum. Also to fix complete 271 burners—being the total number of lights in the district—for £210, the repayment of which amount the Company were prepared to accept by three equal instalments of £70 in six, twelve, and eighteen months' time. The Lighting Committee recommended the Council to accept these terms. After some discussion, in which several members were in favour of experimenting before adopting the light throughout the parish, the subject was referred back to the Committee.

**German Incandescent Gas Share Company, Limited.**—The first general meeting of this Company was held last Thursday, at the Cannon Street Hotel—Mr. J. H. Lukach in the chair. The Chairman stated that the meeting was only formal, to comply with the requirements of the Act of 1867. The Company was not a manufacturing one, having been formed for the purpose of acquiring shares in the German Incandescent Gas-Light Company of Berlin, of the nominal value of 1000 marks, and to issue against them its own shares of £1 each. Their prosperity therefore depended upon the success attending the business of the German Company, which had continued most satisfactorily. At their recent meeting, the Chairman stated that the success of the burners as well as of the incandescent mantles showed a large increase over that of the previous year, and that this was not in the nature of a mere temporary spurt—the advance being progressive month by month. He thought they might therefore look forward to a long career of prosperity. In reply to questions, the Chairman stated that the Directors had taken steps towards obtaining an official quotation on the Stock Exchange for their shares; but they had met with some difficulty. However, they would give the matter further attention.

## ELECTRIC LIGHTING NOTES.

The Winchester Town Council, who a few years ago obtained a Provisional Order for producing electric light for the city, have not found it advisable to carry it out, and it will expire in June next. An offer has, however, been made by a firm in Westminster to take over the Order on certain terms, which include provision for the purchase of the works by the Council at any time, upon twelve months' notice being given. It is provided that if the purchase takes place at any period within seven years of the transfer, the price is to be the capital expended *plus* 15 per cent.; within 14 years, *plus* 10 per cent.; and at any time after, *plus* 5 per cent. The price to be charged for current to private consumers is not to exceed 8d. per unit for the first year, and 7d. for the second, with a sliding-scale reducing it to 6d. to large consumers; and any current required by the Council to be supplied at 4d. per unit. The firm in question will repay the £350 expended in obtaining the Order. The Council have resolved to accept these terms.

According to the report on the working of the Electricity Department of the Nelson Corporation in the year 1895-6, there was a gross profit of £830. Out of this was taken the interest on loans, &c., less credits, £324; and a sum of £250 was set aside for the depreciation and sinking fund—together £574. This left a surplus of £256. The Corporation have raised £9960 out of the £10,000 sanctioned; and on the 25th of March last the whole of this had been expended. The proportion of gross profits to the capital (the outlay during the year being averaged) was 8·43 per cent.

Another step was taken by the Bath Town Council at their meeting last Tuesday towards completing the arrangements for taking over the Electric Light Company's works. The Committee who have the scheme in hand have been empowered already to apply for a loan of £45,000 with this object in view. But a determination to extend the lighting area as well as to increase the plant, so as to provide better facilities for private lighting, has made further expenditure necessary; and the required sum is now expected to reach nearly £59,000. The report recommending this additional expenditure was adopted by a large majority.

At the last meeting of the Fleetwood Urban District Council, it was reported that the Electric Lighting Order had been disposed of for £600—all buildings to be wired free. The Company who have purchased the Order will be known as the Fleetwood and District Electric Lighting and Power Syndicate.

The Electric Lighting Committee of the Hampstead Vestry, having considered the question of the sudden increase in the rates of the Norwich Union Fire Insurance Office for the buildings and contents of the electric lighting station (from 5s. to 10s. 6d. per cent.), to which reference was made at the meeting on the 8th inst., reported to last Thursday's Vestry meeting that the higher charges were decided upon by the Fire Offices Committee, and therefore are the same as those quoted by other offices; that there was apparently nothing unusual in the short notice given; and that the rates would be the same whether the insurances are effected directly with the head offices of the Companies or through agents. The latter statement rather discounts the startling announcement made at the previous meeting, that the son of the former Chairman of the Electric Light Committee was the agent in question. Still, as a member assured the Vestry that he could prove that lower rates can be obtained, and declared his intention of putting a motion on the paper, the matter will be heard of again. The whole affair is a curious commentary on the safety of electric lighting from a fire-risk point of view.

The application of the Shoreditch Vestry for a loan of £31,381 for the Pitfield Street electric light and refuse destructor premises, plant, &c., came before the London County Council last Tuesday. The Council's Engineer and Architect have examined the estimate of the proposed works; and the Finance Committee considered that part of these items should be deducted, and the loan reduced for the present to £29,655. The Vestry asked that the whole amount might be treated as one loan, and the repayment spread over 42 years. But the Committee were not disposed to recommend the Council to depart from the usual course of having regard to the life of the works in all cases except for electric lighting undertakings, and considered that the period for repayment of the buildings and plant for the dust destructor should be limited to 30 and 15 years respectively—the period of 42 years being confined to the cost of the electrical installation. The report was agreed to by the Council.

Aldermen Stocks and Calvert are the Chairmen respectively of the Gas and Electric Lighting Committees of the Huddersfield Town Council; and they are very jealous of the interests confided to their care. This was apparent at the meeting of the Council last Wednesday, when the Central Wards Committee presented a report showing the comparative cost of lighting the streets by electricity and gas. On the motion for the adoption of the minutes, Alderman Calvert read a copy of a letter addressed by the Gas Engineer (Mr. W. R. Herring) to the Gas Engineer of Derby inquiring as to the charges for electric supply in that town; and the Alderman complained that Mr. Herring had interfered in business which did not concern him. Alderman Stocks defended Mr. Herring's action, saying that he had asked Alderman Calvert for information which had not been furnished; and the only alternative was to seek it where it could be obtained. He contended that the electric lighting works were not as yet self-supporting, and that the public lighting thereby, so far as it had been carried out, was more expensive than gas. Mr. Inman stated that the cost of lighting a certain area of the Central Ward by electricity was £130 13s. less than by gas; the cost by the latter amounting to £806 14s. But the question of economy had not been considered by the Committee, who desired first of all to get a better light than gas afforded. Several members of the Council complained of the inefficiency of the gas lighting. Alderman Stocks proposed that a Joint Committee should be appointed to go into the relative costs. But this was defeated; and the recommendation of the Committee was adopted. Later in the proceedings, Alderman Calvert, referring to a statement of Mr. B. Shaw that the electric lighting works had been subsidized to the amount of £6000 during the last three years, said the department

spent a large amount of money before they began to earn a penny, which was the case with most other departments of the Corporation. He pointed out, however, that in September last year the consumption was between 14,000 and 15,000 units; and up to September this year, the increase had been about 52 per cent. He proceeded to answer the questions put by Alderman Stocks, who, he said, would have had the replies earlier if he had attended the last meeting of the General Purposes Committee. Alderman Stocks contended that the Electric Lighting Committee could not possibly produce the light at the price charged for public lighting; and the matter then dropped.

The first move has been made in an effort to form an electric lighting company for Lewes; but so far as can be seen, the people are not very enthusiastic over the matter. A meeting of the inhabitants was held to consider the question yesterday week; but only a few accepted the invitation to be present. It was convened by Alderman Farncombe, who appeared to have no interest in the matter beyond a desire to do a good turn for Mr. W. G. Walker, Assoc.M.Inst.C.E. This gentleman addressed the meeting; but he was not prepared with a detailed scheme for the lighting of the town. His only object on this occasion was to show the benefits of electric lighting in comparison with gas. He trotted out all the stereotyped arguments as to the light being clean, comfortable, pure, and healthy; but it was in dealing with the relative cost of the two illuminants that he must have made his auditors open their eyes, and wonder why they had so long remained without this cheap and perfect form of lighting. He said the light could now be supplied at less cost than gas; and this was found to be the case in several northern towns, where the price of the latter was as low as 1s. 10d. per 1000 cubic feet. Very much greater candle power could be obtained per pound of coal by electrical agency than by the gas from the coal; the average figures being as follows: The gas from 1 lb. of coal gave about 18-candle power; while 1 lb. of coal in electrical agency gave about 48-candle power with incandescent lamps, and 290-candle power with arc lamps. An ordinary 5-feet gas-burner gave the same light as an 8-candle power electric lamp; each giving virtually 10-candle power. The mean consumption of gas per annum for such a burner was 3000 cubic feet; and the mean consumption of electrical energy for the electric lamp was 18 units per annum. An electrical unit was equivalent to an 8-candle power lamp burning for 30 hours. The mean lighting hours of the gas-burner were 600 per annum; and the mean lighting hours of the electric lamp, 460 hours per annum. This meant that gas at 3s. per 1000 cubic feet cost the same as electricity at 6d. per unit; and the mean revenue per lamp at these prices was 9s. per annum for each illuminant. The price of gas in Lewes was 3s. 10d. per 1000 cubic feet; and the corresponding price for electricity would be 8½d. per unit. The population of the town was about 12,000, with, he understood, 2360 houses; and there were about 3½ miles of main roads. He estimated that there would be in the near future a demand for the equivalent of 4000 8-candle power lamps. Not more than 3000 lamps would be expected to be alight at the same time; and therefore it would only be necessary to put down generating plant for 3000 lights, which would require about 150-horse power, with a reserve of 200-horse power. This would require a capital of £10,000; but the expenditure of all this would not be required at once. A very good start could be made with a capital of £5000, which would be enough for about 1600 lamps. He also estimated that the working expenses would be £800; and allowing £350 for reserve and depreciation, the profit would be sufficient to pay a dividend of 5 per cent. on a capital of £10,000. This estimate was on the assumption of a night load only; but there was, he added, absolutely no reason why a demand for electrical motive power should not spring up and produce a day load. Moreover, a day load could be economically supplied at (say) 5d. per unit. Alderman Farncombe suggested that a laundry might be worked in conjunction with the generating station, and so utilize the engine power during the daytime. Beyond a vote of thanks to Mr. Walker, no resolution was passed; but an intimation was made that communications on the subject might be forwarded to Alderman Farncombe, who would see they reached the proper quarter. If those present at the meeting contemplate taking any further step in the matter, it would be well for them to first corroborate the above statements.

The Newmarket District Council resumed last Wednesday the discussion on the proposal that the Council should apply for a Provisional Order to empower them to supply electricity in the town. The previous proceedings were noticed in the "JOURNAL" for the 13th inst. (p. 701). A letter had, in the meantime, been received from the Chairman of the Gas Company (Mr. R. Stephenson) containing the following propositions: "That, at the joint expense of the District Council and the Gas Company, a consulting electrical engineer be instructed to inquire and report as to the prospect of an electric lighting system being remunerative in Newmarket, and especially to advise (1) whether the Council could undertake the lighting of the district, or any part of it, with a fair prospect of the undertaking being remunerative; and (2) in such case, whether it would be desirable, in the interest of the ratepayers, to use gas-engines in place of steam for generating electricity." In the event of such an inquiry being made, the Company, in addition to bearing half the cost, would, it was stated, assist in every way in order that the engineer selected should have the most complete data on which to base his opinion. A question arose as to the right of the gas shareholders to speak or vote; and then Captain Webster continued his address, which was interrupted at the previous meeting by the personal altercation between him and Mr. Rodrigo. Mr. Wesley moved that the Council should join with the Gas Company in engaging an expert, as suggested in their letter. Mr. Rodrigo then replied; and after a "scene" between him and the Chairman (Mr. J. Rogers), his amendment to ascertain the views of the ratepayers, either by canvassing or by calling a public meeting, before applying for a Provisional Order, was lost, and a decision come to to make the application. There was afterwards some discussion with reference to the Gas Company's proposals; and it was decided that the matter should be brought forward at the next ordinary meeting.

**Great Marlow Gas Company.**—The shareholders of this Company have authorized the Directors to create and issue £3000 additional capital in ordinary shares. The dividend declared at the recent annual meeting was at the rate of 6 per cent. per annum.

## SHEFFIELD CORPORATION WATER SCHEME.

### Mr. Eaton's Position and Remuneration—A Vigorous Discussion in the Council.

A long, full, and yet unfinished debate on the question of Mr. Eaton's position and remuneration in connection with the new water scheme took place at the meeting of the Sheffield City Council last Wednesday. The importance with which the subject is regarded locally is shown by the amount of space which the Press has been devoting to its discussion. On Thursday last, for example, one paper gave a report of, and comments on, the proceedings in the Council, which together extended over about twelve columns. Here, however, we cannot do more than give a general indication of the trend of the discussion. The opinion of the outside public was represented in the first place by a series of memorials in opposition to the proposals of the Water Committee, which were noticed in the last and previous issues of the "JOURNAL."

On the introduction of the minutes of the Committee containing their amended conditions in regard to the engineering of the new works, Alderman Gainsford, the Chairman, made a lengthy speech, throughout which he adopted a very conciliatory tone. He acknowledged that, when the matter was formerly brought before the Council, sufficient explanation was not given. Then he apologized for a mistake in the first report as to the day and a half that, it was stated, Mr. Eaton would devote to the work. This should have referred solely to the time that he was to give to the consulting work for the existing works alone, and not to the construction of the new works. Describing the Committee's fresh proposals, he showed that they simply amounted to this: That Mr. Eaton would, for the same salary that he has at present, do two things—first of all, he would design and superintend and construct the new works in the Little Don Valley, and, secondly, he would be Consulting Engineer for the existing works, for distribution, and for the Damflask works. It was further proposed that he should have liberty to take outside work, subject to the claims of the Corporation upon the whole of his time for the efficient and full discharge of the duties described. Alderman Gainsford dilated upon the advantages which the Corporation would obtain under this scheme; and his claims may be summed up in the three words "efficiency, economy, experience." Particular emphasis was laid on the knowledge possessed by Mr. Eaton—gained by many years' study—as to the geological conditions of the Little Don and other valleys in which the Corporation water-works were situated; and here the Alderman recalled the Dale Dyke disaster in 1864. Another argument in favour of Mr. Eaton was that the new scheme had been devised entirely by him; and, therefore, he was undoubtedly the best man to carry it into effect. The period of appointment it was proposed should be either of five years' duration, or else from six months to six months, terminable by notice from either party. The financial side of the proposals was next touched upon; and, in this regard, Alderman Gainsford presented two estimates, prepared by competent authorities, as to the cost of the work of the draughtsmen and inspection. One amounted to £7800 for five years, and the other to rather more than £9000. Addressing himself to the expressed desire of certain members that the work should be undertaken by an engineer who would give his whole time to the Corporation, he said that this meant they would have to part with Mr. Eaton, who had been a servant of the Water Committee and their predecessors for a period of 28 years. He did not like to part with old servants. He had given Mr. Eaton an assurance that the Corporation would not cast him off on the morrow of his getting the Bill through Parliament, but that he might take the preliminary steps for considering that he would be Engineer for the construction of the new works. If he had done wrong in saying this, he deeply regretted it; but it was an assurance which he was confident was in the best interests of the Corporation. Of course, it was given subject to arrangements and terms on a proper footing. With only one exception, the recommendation which he presented that day was supported by the old and experienced members of the Water Committee.

The opposition was led by Mr. Fisher, who moved an amendment that the proceedings relating to Mr. Eaton be not confirmed, but that the Committee be instructed to carry out the engineering of the works by "the employment of a resident engineer of established reputation at a salary, such resident engineer to devote the whole of his time to the works; the Corporation to have power, in their discretion, in case of any special circumstances or difficulty, to be supported with a second engineering opinion at their own expense." He disclaimed having any personal animus against Mr. Eaton. The comfort, the health, and the very lives of a large number of the citizens depended upon the care, the skill, and the constant vigilance of those who were appointed to carry out these important works; and the speaker's arguments were directed to showing that they would not obtain this by Mr. Eaton having an office in London, and being open to the calls of other authorities. In support of his case, he read letters showing what had been, and was being, done at Leicester, Plymouth, Cardiff, Bury, Leeds, and Bradford. At these places, important water-works were constructed by the resident engineers; and, in certain instances, a professional engineer was consulted. As to the authorship of the new scheme, he held that its inception was as much due to Mr. Crowther as to their own Engineer. He was sure that, if Mr. Eaton elected to be in the exclusive service of the Corporation, and relinquished his idea of becoming a practising engineer and taking work elsewhere, he would be very tenderly treated. The accident to the Dale Dyke reservoir he held up as a warning to the Council, maintaining that this calamity was due to lack of constant supervision.

The next speaker was Mr. J. Maxfield, who, as a member of the Water Committee, confessed that he did not understand its work as a member ought to do. Upon one passage in his remarks a great deal could be said: How much better, he observed, it would have been if, before they went to Parliament, Mr. Eaton or the Chairman of the Committee had taken the whole Committee fully into their confidence, and Mr. Eaton had said that at the end of twelve months he should leave them, and, if they gave him the inception of the work, he should want them

to let him have the construction of it. They would then have understood their position fairly; but to come before the members at the last moment, and tell them that this arrangement had been made, when no one else knew of it, was an unwise thing to do. He also contended that the magnitude of the contemplated work was sufficient to tax the whole energies of an engineer. Mr. Hughes followed; and he testified to the high regard in which Mr. Eaton was held in the engineering profession. He was also firmly of opinion that to throw away the knowledge Mr. Eaton had acquired would be a most foolish thing for the Corporation to do; and he asked whether it was likely their Engineer would leave a solitary stone unturned which would enable him to make a success of this undertaking—knowing perfectly well that any flaw or mistake in the construction would completely destroy his reputation as a Consulting Engineer. Alderman Brittain suggested that Mr. Eaton be offered the position of Resident Engineer at a salary in excess of the present one; it being understood that another engineer be consulted as required. Mr. Styring, referring to Alderman Gainsford's remark as to old servants, repudiated the statement that the Corporation were turning their backs on their Engineer, and held that it was rather the other way—that Mr. Eaton was turning his back on the Corporation. In face of a contradiction by Alderman Gainsford, Mr. Styring adhered to a statement that an identical scheme to the one over which their discussion had arisen, and the inception of which was claimed for Mr. Eaton was projected by the late Mr. T. Hawksley for the old Water Company in 1866. The upper or Langsett reservoir, he said, was placed in precisely the same position; and the embankment of the lower reservoir was situated a little lower down the valley than in the present scheme, because at that time it was proposed to make the reservoir a little larger. At the close of Mr. Styring's speech, the discussion was adjourned.

## THE NEW WORKS OF THE STOCKTON AND MIDDLESBROUGH WATER BOARD.

### Construction of Extensive Filter-Beds.

The Stockton and Middlesbrough Water Board have well in hand the construction of some large filter-beds at Lartington; but it was felt that the magnitude and importance of the work demanded some formal initiation. Therefore arrangements were made for the cutting of the "first" sod by Alderman W. Bulmer, J.P., the Chairman of the Middlesbrough Committee; and this took place on Tuesday last, in the presence of a numerous and influential company. Arriving at Hury, the party assembled in the offices of the Board on the Hury embankment; and here Alderman Hugh Bell, the Chairman of the Board, made a speech in which he gave some information as to the vastness of the water undertaking. The original purchase money, he said, was £800,000; and the Hury reservoir had cost an additional £202,000, and Blackton £155,000, both exclusive of the land. The two reservoirs were jointly capable of holding 1400 million gallons of water; and they formed an almost continuous sheet of water 2¼ miles in length, with a maximum depth of 90 feet. Practically the whole of the work in connection with the reservoirs had been carried out according to the plans of Mr. J. Mansergh and under contract with Messrs. W. Scott and Sons, of Newcastle. The Contractors had taken measures to afford them an opportunity of seeing whether the dam was sound; and so far as they had been able to judge, no water whatever was finding its way round the end of the dam. In the watershed from which they took the water, there fell as much as would over and over again satisfy their demands if they had reservoir space to keep it; but the difficulty was that the rainfall was not regular. The obligation of the Water Board was in the first place to afford to the Rivers Balder and Tees compensation to the extent of 2325 gallons per minute; and arrangements had been made so that at all times this quantity of water should flow out of the Hury reservoir. Alderman Bell also mentioned that, in the case of the Blackton reservoir, the Board had fortunately been saved the anxiety and difficulties incident to the construction of the Hury embankment. It was so built that, when the water was sufficiently clean, the person in charge could admit it into the Hury; but when it was in flood, the water was discharged into the river without disturbing the Hury supply. From Blackton the members of the Board and their guests were driven to Lartington, where the chief ceremony of the day was to be performed. Again addressing the company, Alderman Bell said the Board were now taking the last step in the great water-works scheme which they had been carrying through. Their object now was to rid, as far as might be possible, the excellent water which they collected from the adjacent moors of the suspended matter which it might contain and the discoloration which was due to the peaty surface from which it flowed. He hoped, in the course of a couple of years they would possess a system of filtration which would be the means of delivering the water to the consumers free from those trifling matters which rendered the water less agreeable to the sight than it would be when the filter-beds were completed. Then the whole of the system of the Board in the valley of the Balder would be finished; and it would remain for the Board to consider how soon it would be necessary to proceed with the works in the adjoining valley of the Lune. The rapidity with which the demand for water had increased had been very remarkable; and if this would only continue, it might not be far distant when, instead of being in any way a burden to the community, the works would be a source of revenue to them. At the present moment, the revenue from the works was sufficient to pay interest at rather more than the rate of 3 per cent. on the total expenditure; and the Corporations were able to borrow money at a rate which would not be much of an imposition. But if the demand for water went on growing as at present, one would fain hope that the Board would before long be able to say that they had an entirely self-supporting undertaking. Alderman Bulmer was then presented by Mr. John Scott, of the firm of Contractors, with a very handsome silver and ebony spade, and by Mr. Mansergh with a valuable oak, ebony, and silver-mounted barrow, bearing a suitable inscription. Alderman Bulmer, amid cheers, cut and tipped the first sod in workmanlike fashion, and then heartily thanked the Contractors and Engineer for their handsome presents.

## THE OWNERSHIP OF UNDERGROUND WATER.

The above question was dealt with in a paper read by Mr. C. H. Cooper, Assoc.M.Inst.C.E., Engineer and Surveyor to the Wimbledon District Council, at the recent congress of the Sanitary Institute.

The author began by remarking that the appropriation of water supplies had to be submitted to on account of the law relating to underground water, which did not recognize any ownership or right of user of such water. He then went on to say that the action of *Chasemore v. Richards*, tried in 1859, was a standard case on this point. There a landowner and a miller who had for upwards of sixty years enjoyed the use of a stream which was chiefly supplied by percolating underground water, lost it after an adjoining owner had dug on his own ground an extensive well for the purpose of supplying water to the inhabitants of the district, many of whom had no title to the water as landowners. It was held that the millowner had no right of action. In *Acton v. Blundell*, tried in 1844, it was held that "the owner of land through which water flows in a subterraneous course has no right or interest in it which will enable him to maintain an action against a landowner who, in carrying on mining operations in his own land in the usual manner, drains away the water from the land of the first-mentioned owner, and lays his well dry." Lord Chancellor Hatherley, in the case of the *Grand Junction Canal Company v. Shugar*, tried in 1880 and 1881, observed: "I do not think *Chasemore v. Richards*, or any other case, has decided more than this—that you have a right to all the water you can draw from the different sources which may percolate underground. But this has no bearing at all on what you can do with regard to water which is in a defined channel, and which you are not to touch. If you cannot get at the underground water without touching the water in a defined channel, I think you cannot touch it at all." In legal decisions, the author went on to say, there was far too great a tendency to base them on cases already decided, although, when these cases were tried, the knowledge of the matters in question was very scant compared with that now possessed. The methods at present at hand of obtaining information, and the improvements that were being made from year to year, would, it might be supposed, lead Courts of Justice to found their decisions on the principles that govern the matters in question, rather than on bygone decisions made when those principles were not known. He would regret to see any undue restrictions placed on the acquisition of underground water; but legislation should, in his opinion, prevent the rights of others from being damaged. The author went on to refer to a case in which a company made borings, causing a diminution in the supply of water to houses from public wells, and doing away with numerous artesian wells altogether. The population formerly supplied by these wells was 7000, in addition to which several factories derived their supply from the same source.

In the course of the discussion on the paper, Mr. W. Logan said that in the North they had thrashed this matter out long ago. He thought the law had always been very clear and explicit on the matter—that no person had a right of ownership in an underground supply of water except that which was beneath his own ground. Any person might make a well, and sink it deeper than his neighbour's well, and take away his water, without in any way being liable. Earl Percy (the President of the Institute) said the last speaker had stated the law correctly; but he should like to know what was the remedy. At the present time, the town of Morpeth was, he believed, very hard up for water, largely owing to the working of coal mines. What was the remedy? How could any expert tell what would be the consequence of pumping water from a particular place? They would be landed in the most dreadful series of litigation and doubt if they once began to try to prove that a particular want of water was caused by the special operation of anyone. He did not see how the difficulty was to be met, except in one way. In the case of water companies, they had to go to Parliament for powers. Where this was done, and Parliament saw any strong probability that the operations of the company would affect the water of the surrounding district, they sometimes put a certain obligation on the company to supply the district at a reduced cost, or something of that sort, to meet the difficulties of the district. This was the only way, it seemed to him, in which the matter could be met; and it was for the inhabitants of a district, when a water company went to Parliament, to look out for these things, and insist that a protective clause should be put in the Bill. Mr. Cooper, in reply, said Earl Percy had referred to a town where coal workings had interfered with the water supply. Could they imagine anything worse than that some private person, because he owned a coal mine, had a right to deprive a town of its water supply? If the coal was worth winning, surely the landowner ought to compensate the town. He did not think for a moment that the law was right as it stood. Earl Percy explained that he did not mean to say that any landowner or colliery proprietor had taken the water supply from a town with which he was acquainted. What he meant was that coal workings had done it, or were supposed to have done it, in a district full of coal pits. The difficulty was to find out which of the owners was liable.

**A Water Scheme for Whaley Bridge and District.**—The Water Committee of the New Mills District Council have had an interview with Mr. Toler, agent for Colonel Cotton-Jodrell, M.P., in regard to a scheme for supplying the district of Fernilee, Whaley Bridge, Furness Vale, and a portion of New Mills with water. Mr. Toler explained that the site of the proposed reservoir is in Taxal, on Colonel Cotton-Jodrell's estate, where the gathering-ground extends over some thousand acres. The cost of the scheme will be at least £25,000.

**The Water Supply to Dublin Out-Townships.**—A series of resolutions has been passed by the Kingstown Town Commissioners respecting the supply of water by the Dublin Corporation. It appears therefrom that they are willing that the Corporation shall supply the township with water by meter at a uniform rate per 1000 gallons; that the terms and conditions of the supply shall be referred to arbitration at the joint expense of the Corporation and the Commissioners; and that a Bill shall be promoted in the next session of Parliament to confirm the award.

## NOTES FROM SCOTLAND.

**From Our Own Correspondent.**

*Saturday.*

To-day Counsel were heard upon the evidence in the Dunfermline gas transfer. The sitting was in the same apartment in the Balmoral Hotel in Edinburgh in which nearly the whole of the evidence was led. A minute was put in for the parties, agreeing that the transfer shall be held to have taken place as at the close of the last financial year of the Company, which was May 31 last. This looks like a peculiar arrangement, because it virtually means that the gas undertaking has, for four months and a half, been the property of the Corporation, but has been managed by the Directors of the Company. The decision is founded on legal advice, according to which there seems to be some inability to order a fresh valuation of stocks on hand. The notion is to avoid doing anything illegal, which is certainly right; but is it not possible that this advice leads to the perpetration of a greater illegality than would be the case were a fresh valuation to be made? By the Burghs Gas Supply Act, under which the transfer has been made, the Corporation are required to appoint a Committee of their own number to manage the undertaking. They have not done so. On the other side of the question, it is by the same Act declared that, "from and after the date when the Commissioners shall have become vested with the undertaking of any company, the company shall subsist only for the purpose of . . . . winding up the affairs of the company, and carrying into effect the purposes of this Act, so far as relates to the affairs of the company." The Company have done much more than subsist merely for the purpose of winding up, since May 31. They have made and sold gas, entered into contracts, and otherwise actively conducted the undertaking—and conducted it too, there was some slight insinuation, in a way to suit themselves rather than the town. That was only natural, though, of course, they could have done nothing of consequence to have either greatly improved their own interests or prejudiced those of the town. This is not the point. It is that the Corporation did not appoint a Committee to manage the undertaking, after it must be held to have come into their hands; and the Directors of the Company continued to manage it, after it must be held to have passed from their hands—both contrary to express stipulations of the statute. It is almost, I am sure, unnecessary to explain that the Directors could not, in terms of the same Act, have given up the management till they had received payment of the price, which the arbitration has been held for the purpose of fixing; and the Corporation could not have assumed the management until they had received a valid conveyance of the undertaking, which could not be prepared until the price was fixed. This is an awkward state of matters to arise, all on account of ante-dating the transfer. It is most probable that it will not interfere with the transaction; but it gives the opportunity to a competent objector to take both parties into Court in an endeavour to reduce the transfer. Suppose the price to be fixed by the Arbitrators should be considered by an aggrieved ratepayer to be too high, he would have an interest to object; and any flaw in the proceedings would give him a handle. Suppose, on the other hand, that the shareholders of the Company should consider the price fixed to be too low, they would have the same rights and interests. Such a situation would then arise as would tax the ingenuity of not a few learned gentlemen to get out of. For instance, while the litigation lasted—which would probably be for two years—who would manage the gas undertaking? I suppose a judicial factor would have to be appointed, who would work under the supervision of the Court, and who would accumulate the profits, to be handed over to whomsoever should turn out to have been the owner—neither shareholders getting dividend, nor sinking fund being created, nor any of the other functions of a Company or Corporation being exercised. Efficient management could scarcely be looked for from a judicial factor. A deficit might be the result; and upon whom would this fall? Naturally the ultimate owners of the works would have to make it up. If these should turn out to be the Company, it would be hard upon the shareholders to have had their business disturbed, and to be penalized for the blunder of the Corporation, when, if they had been left alone, they would have been extending their business and earning dividend all the time. If the Corporation should be the owners, the expenses of the litigation and the deficit would fall to be added to the costs of the arbitration; and this would be equally hard upon the ratepayers. These are, of course, only possibilities; but they are possibilities which may very well arise, and they would not have arisen but for this step of ante-dating the transfer.

As to the hearing to-day, it was a very long and dreary affair. Mr. Asher, Q.C., for the Company, occupied the time of the tribunal from ten till two o'clock; and Mr. Shaw, Q.C., for the Corporation, from then till nearly six o'clock—about eight hours of solid talk. How absurd, when it is remembered that the three gentlemen who were being addressed knew more about the subject than the legal gentlemen who were addressing them! In what I heard of it, in fact, the position of the Arbitrators appeared to consist of a constant watching for, and putting right of, Counsel when they went aside. The position taken up by Mr. Asher was that the maintainable profit of the Company was equal to what they had been earning, and that the basis of the sale to the Corporation should be 26¾ years. His reliance was chiefly upon the excellent position of the Company, in the matter of works; and on this matter he had, as technical adviser, Mr. A. MacPherson, of Kirkcaldy. Mr. Shaw, on the other hand, bestowed most of his time to the balance-sheets and accounts of the Company. He had no engineer for adviser; but on the finance side, he was assisted by Mr. R. Cockburn Millar. There was thus a clear distinction between the two sides—the Company relying upon actualities and possibilities in the matter of working, and the Corporation upon what Counsel seemed to regard as bungling in the book-keeping of the Company. Mr. Shaw laid great stress upon the view that the Company had, when they erected their new works, entered the value of them in their capital account, and had also retained the capital value of the old works. In all the circumstances, he held that 22½ years should be the basis of the purchase by the Corporation; and that the price should be £57,960 or £59,420. It now lies with the Arbitrators to fix the amount. I may recall that the claim of the Company is for £140,000; so that there is fully £80,000 of difference between the parties. In these circumstances, it is considered unlikely that the two Arbitrators will agree; and then the fixing of the price will devolve upon Mr. Shiress Will, Q.C., the Overs-man. Considering the mass of material they have to wade through, the award need not be expected for a little; it would scarcely be decorous to the parties, after their providing so much to be thought over, to throw out the result too early.

The Corporation of Dundee have lost no time in filling up the post of Manager of their gas-works. It was only on the 12th inst. that Mr. John M'Crae died. Yesterday the Corporation, at a special meeting, appointed Mr. William M'Crae, the late Manager's brother, to the post. The Gas Committee, who recommended Mr. M'Crae, did so on the ground that by his promotion from the position of Assistant Manager to that of Manager, they would be able to abolish the former post, and thereby effect a saving. In the Council meeting, an attempt was made to have the appointment delayed, in order that they might be able to satisfy themselves that Mr. M'Crae was the best man, and that the appointment should, in the meantime, be only an interim one. Ex-Provost Ballingall, who moved Mr. M'Crae's selection, said that the question of an interim appointment had been considered by the Committee; and the course recommended was considered the best. This was a very large department. There was a great body of men there; it was the busy part of the year; and it was very important that there should be at the head a man to whom the workmen and others could look up. Mr. M'Crae had been sixteen years in their service; and he was very well qualified to fill the position. He thought they were doing only their duty, when they had sufficient ability in their staff, if they promoted their own servants rather than bring men from the outside to fill important positions. The Council agreed to Mr. M'Crae's appointment; and, by 18 votes to 4, they declared it to be permanent. A remit was made to a Sub-Committee to report upon the salary to be paid to Mr. M'Crae. The suggestion was made that it should be fixed at £350, at which figure, with the abolition of the office of Assistant-Manager, there would be an annual saving of £450. Mr. M'Crae is to be congratulated upon his appointment, for which he is in every way well qualified, both by ability and experience. But the Corporation are also to be congratulated upon their filling up the vacancy so promptly. They could scarcely have given it to any other than Mr. M'Crae; and to have delayed making the appointment would not only have been a trouble to the Councillors themselves, but would have led to great heartburning among the unsuccessful applicants. All this has been saved. Mr. M'Crae succeeds his brother and his father, which is probably a unique position in the history of gas undertakings. At the same meeting of the Council, Lord Provost Sir James Low moved that the Council express their sympathy with the relatives of the late Mr. John M'Crae, and that an excerpt of the minute be sent to them. This was, of course, unanimously agreed to.

The Council also transacted an important item of business in connection with the gas undertaking. A General Bill has been in contemplation for some time; one of the objects of which was to be an extension of the borrowing powers in connection with the gas supply, which are practically exhausted. At yesterday's meeting, it was proposed not to proceed with the Bill in the meantime, as it was thought they might get on as they had been doing for a year or two yet. Treasurer Ritchie said that the same thing was brought forward last year—that there was no need for going to Parliament—the remark being made that they had better get everything included in the Bill; and the heads of all departments were asked to prepare for going to Parliament for the powers needed. He was convinced now, as he had formerly been, that they should have the capital account and the borrowing powers of the Gas Commission on the same basis as in a private business. It was not creditable for a public Board to override Acts of Parliament while asking others to obey them. If it were not desired to go to Parliament, let it be understood that the onus rested on the shoulders of those who objected. He moved that they adopt the recommendation to go to Parliament. Ex-Povost Brownlee seconded. For years, he said, it had appeared that the finances of the Gas Commission should be put on a better footing. They were in the position of having something like £60,000 at the credit of the sinking fund. They were using this, as they ought not, for the purpose of carrying on the affairs of the gas-works; and they were, in addition to that, putting something like £1500 annually to the credit of sinking fund. In short, the finances of the gas department were quite waterlogged; and the difficulty must, and ought to be met. The Council resolved upon delay, whereupon Ex-Provost Ballingall said he would take the earliest opportunity of resigning the convenership of the Gas Committee; and all who had supported him protested that they would not hold themselves liable for any overdraft on the gas account. At present, such is the condition of the accounts, although the undertaking is financially sound in every respect, that members of the Council are personally liable for overdrafts, which is a position that ought not to exist.

The new gasholder at Gourock, for which the Gas Commissioners, as will be remembered, required to obtain special permission from the Sheriff of the County before they could proceed with its erection, was formally inaugurated last Saturday; Provost Steel performing the ceremony of turning the gas into it. The holder has been built under the supervision of, and to designs by, Mr. J. M'Gilchrist, of Dumbarton. It is a telescopic holder, of 120,000 cubic feet capacity. The contract for the whole work was in the hands of the Airdrie Iron Company, who themselves supplied and erected the cast-iron tank and guide-framing; the floating part of the holder being sub-let to Messrs. Hanna, Donald, and Wilson, of Paisley, and the excavations to Bailie Barlas, of Dumbarton. The company who assembled by invitation of the Commissioners were photographed; and then prayer was offered up by a clergyman—whether for the company or the holder is not clear, but it was surely an out-of-the-way proceeding to have a special invocation on the occasion of the opening of a gasholder. The company were afterwards entertained to dinner. Gourock is a growing place; and the new holder will be a valuable aid to the Gas Manager (Mr. J. M'Ewan) in meeting the demand for gas.

In the last financial year of the Alva Gas Commissioners, the output of gas was 8,069,600 cubic feet—an increase of 977,000 cubic feet over the preceding year. The illuminating power of the gas was 27·70 candles. During the past three years the Commissioners have reduced the price of gas by 10d. per 1000 cubic feet. Of the increased output of gas, 300,000 cubic feet was due to the introduction of prepayment meters.

Bailie M'Hale, the Convener of the Gas Committee of the Hamilton Corporation, gave some interesting figures regarding the gas supply of the burgh, at a meeting of electors on Tuesday night. He believed, he said, that they would all agree with him, when he had given them the figures, that the practical reconstruction of the gas-works had not come a day too soon. In 1891-92, the coal carbonized was 7515 tons; in 1895-96, 10,032 tons. The gas made in 1891-92 was 61,738,000 cubic feet; in 1895-96, it was 95,637,000 cubic feet. This, in ordinary circumstances, should mean a great increase of income; but, as they were aware, the price of gas was reduced very considerably. In his opinion, it was better to have effected this reduction, giving consumers the benefit, than to have hoarded up money, or to have written off unnecessary sums for depreciation. The income of the gas department had not increased on two accounts—the reduction in the price of gas, and the fall in the price of the secondary products. While in 1891-92, 372,963 gallons of liquor realized £1893, last year 558,338 gallons realized only £1491. This, of course, was owing to the great fall in the value of sulphate of ammonia. These figures showed, in one way, that great progress had been made; and there was another set of figures which proved the fact more markedly. Taking a day's consumption of gas in 1891, it amounted to 340,000 cubic feet; and taking a day's consumption in December of last year, it amounted to 703,000 feet. That was to say in four years the maximum output for the day had more than doubled. It was only reasonable to hope that in the course of four, five, or six years, the maximum output would again be doubled, and that, instead of 340,000 cubic feet, they would have an output of 1,500,000 feet. If the consumption should reach this figure, the state in which the gas-works would be, when completed at the end of December next year, would enable them to make 1,750,000 cubic feet of gas per day. Another idea of the progress made was to be noted in the fact that in 1886 the wages bill for the gas-works was £1304, and last year it amounted to £3749. He felt confident, however, that the wages would not increase in the same ratio as the output. Another feature which he asked them to observe, would show the Progressive Union and the other bodies who sympathized with them that the interests of the workmen were not being neglected. In 1886, the average weekly wage was 22s.; in the present year it was 27s.—and that with a shorter day. He thought he had said enough to show that the Gas Committee had done their best to supply good and cheap gas; and if the newly-constructed works came up to his expectations, he might confidently promise them that, by the end of next year, the Committee would be able to make another substantial reduction in the price of gas, and would be in the proud position of supplying the best, and certainly the cheapest, gas in Scotland. I understand that the wages bill last year was inflated by the payments to workmen engaged on the extensions at the works.

After remaining during a long period in a state of suspended animation and inactivity with regard to the question of the adoption of the electric light, the Paisley municipal authorities who are in favour of it have at length taken action, to the extent, at all events, of endeavouring to secure an eligible site for the erection of their central lighting station. But the electric light advocates of Glasgow's big "suburb" are not to get things all their own way, for the able and zealous Corporation Gas Engineer (Mr. George R. Hislop, F.C.S.) has resolved on telling the townspeople what the modern systems of manufacturing illuminating gas can do in the way of providing them with artificial light. He is to do so through the medium of a public lecture forming part of this winter's course organized for the Paisley Philosophical Institution, in whose membership he has long held an honoured place. In like manner, Mr. J. M'Gilchrist, the Dumbarton Corporation Gas Engineer, has consented to give, under the auspices of the Mechanics' Institution of that town, a lecture on "William Murdoch, Inventor of Gas Lighting: His Life and Work," which will be experimentally illustrated.

## CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *Oct.* 24.

**Sulphate of Ammonia.**—The weakness last reported still continues. The same influences are at work, and have resulted in a further decline in values—closing quotations being: Leith, £6 17s. 6d. to £6 18s. 9d. per ton; Hull, £7 2s. 6d.; and Liverpool, £7 3s. 9d. For delivery up to the end of the year, there are sellers at a shade above spot prices, and over the first four months of 1897 at about £7 10s. per ton London and Leith. Makers, however, although meeting the market freely in the prompt position, are not sellers for delivery ahead, unless at a prohibitive premium.

**Nitrate of Soda** is a shade firmer; and 8s. per cwt. is now required for fine quality on spot.

LONDON, *Oct.* 24.

**Tar Products.**—A determined effort is being made to depress benzols; but it is difficult, however, to see how such a movement can be successful. Neither makers nor consumers have any stocks; it is known that a number of uncovered speculative sales have been made; the aniline trade is remarkably good; and the purchases for gas enrichment, made when benzol was cheaper for a long period, are very large. Solvent naphtha is firm; but crude naphtha has seriously fallen in value. Pitch, if anything, is slightly better; but buyers are somewhat indifferent. There is undoubtedly a better tone; and it remains to be seen whether this will lead to better values. Carbolic acid is well inquired for; and the same remark applies to coal tar oils. There is a good demand for naphthalene; and this is likely to continue.

Values obtaining during the week are: Tar, 18s. 6d. to 26s. 6d. Pitch, 28s. to 30s. Benzols, 90's, prompt, 4s. 3d.; forward, nominal, 4s.; 50's, prompt, 3s.; forward, nominal, 2s. 10d. Toluol, 2s. Solvent naphtha, 1s. 6d. Crude, 30 per cent., naphtha, 1s. 3d. Creosote, 2d.; liquid, 2½d. Heavy oils, 4½s. Naphthalene, 62s. 6d.; salts, 32s. 6d. Cresylic acid, 9½d. Carbolic acid, 60's, 1s. 10d. Anthracene, "A," 10d.; "B," 8½d.

## GAS AND WATER COMPANIES' STOCK AND SHARE LIST (see ante, p. 786).

| Issue. | Share. | When ex-Dividend. | Dividend or Dividend & Bonus. | NAME. | Closing Prices. | Rise or Fall in Wk. | Yield upon Investment. |
|---|---|---|---|---|---|---|---|
| £ | | | p. c. | GAS COMPANIES. | | | £ s. d. |
| 590,000 | 10 | 15 Oct. | 10½ | Alliance & Dublin 10 p. c. | 22—24* | .. | 4 7 6 |
| 100,000 | 10 | ,, | 7½ | Do. 7 p. c. | 17½—18½* | .. | 4 1 1 |
| 300,000 | 100 | 1 July | 5 | Australian (Sydney) 5 % Deb. | 108—110 | .. | 4 10 11 |
| 200,000 | 10 | 12 June | 5 | Belgrano (B. Ayres), Limited | 10½—10¾ | .. | 4 13 1 |
| 100,000 | Stck. | 26 June | 5 | Do. 5 p. c. Deb. Stk | 100—103 | .. | 4 17 1 |
| 200,000 | 5 | 29 May | 6½ | Bombay, Limited | 7¾—8¼ | .. | 3 18 9 |
| 40,000 | 5 | ,, | 6¼ | Do. New, £4 paid | 5¾—6 | .. | 4 6 8 |
| 380,000 | Stck. | 13 Aug. | 12 | Brentford Consolidated | 285—290 | .. | 4 2 9 |
| 210,000 | ,, | ,, | 9 | Do. New | 215—220 | .. | 4 1 9 |
| 50,000 | ,, | ,, | 5 | Do. 5 p. c. Pref. | 140—145 | .. | 3 9 0 |
| 159,375 | ,, | 12 June | 4 | Do. 4 p. c. Deb. Stock. | 130—134 | .. | 2 19 9 |
| 220,000 | Stck. | 16 Sept. | 11½ | Brighton & Hove Original | 242—247 | .. | 4 13 1 |
| 208,820 | ,, | ,, | 8¼ | Do. A Ord. Stk. | 185—190 | .. | 4 9 5 |
| 933,500 | Stck. | 28 Aug. | 5 | Bristol, 5 p.c. max. | 127—132 | .. | 3 15 9 |
| 420,000 | 20 | 15 Oct. | 11¼ | British | 56½—57½* | .. | 3 18 3 |
| 50,000 | 10 | 28 Aug. | 11½ | Bromley, Ordinary 10 p. c. | 22—23 | .. | 5 0 0 |
| 71,000 | 10 | ,, | 8½ | Do. 7 p. c. | 19—20 | .. | 4 5 0 |
| 500,000 | 10 | 15 Oct. | 6 | Buenos Ayres (New) Limited | 10¼—10¾* | —¼ | 5 11 8 |
| 200,000 | 100 | 1 July | 6 | Do. 6 p. c. Deb. | 103—106 | .. | 5 13 2 |
| 150,000 | 20 | 15 July | 8½ | Cagliari, Limited | 29—31 | .. | 5 6 5 |
| 100,000 | 10 | 30 Sept. | 6 | Cape Town & District, Ltd. | 17—18 | .. | 3 6 8 |
| 50,000 | 50 | 2 May | 6 | Do. 6 p. c. 1st Mort. | 58—60 | .. | 5 0 0 |
| 550,000 | Stck. | 15 Oct. | 13½ | Commercial Old Stock | 341—346* | —2 | 3 18 0 |
| 165,000 | ,, | ,, | 10½ | Do. New do. | 255—260* | .. | 4 0 9 |
| 165,000 | ,, | 12 June | 4½ | Do. 4½ p. c. Deb. do. | 152—157 | .. | 2 17 3 |
| 800,000 | Stck. | 12 June | 13 | Continental Union, Limited. | 283—288 | —2 | 4 16 4 |
| 200,000 | ,, | ,, | 10 | Do. 7 p. c. Pref. | 220—225 | .. | 4 8 11 |
| 51,600 | Stck. | 28 Aug. | 14 | Croydon Com'cial A 10 p. c. | 315—320 | .. | 4 7 6 |
| 163,400 | ,, | ,, | 11 | Do. B 7 p. c. | 250—255 | .. | 4 6 3 |
| 535,000 | Stck. | 28 Aug. | 5½ | Crystal Palace Ord. 5 p.c. Stk | 140—143 | .. | 3 13 5 |
| 60,000 | ,, | ,, | 5 | Do. 5 p. c. Pref. | 140—145 | .. | 3 9 0 |
| 486,090 | 10 | 15 July | 11 | European, Limited | 26½—27½ | .. | 4 0 0 |
| 354,060 | 10 | ,, | 11 | Do. £7 10s. paid | 18—19 | .. | 4 6 11 |
| 5,746,590 | Stck. | 13 Aug | 12¾ | Gaslight & Coke, A, Ordinary | 305—310 | —2 | 4 2 3 |
| 100,000 | ,, | ,, | 4 | Do. B, 4 p. c. max. | 110—115 | .. | 3 9 7 |
| 665,000 | ,, | ,, | 10 | Do. C, D, & E, 10 p.c. Pf. | 305—315 | .. | 3 3 6 |
| 30,000 | ,, | ,, | 5 | Do. F, 5 p. c. Prf. | 147—152 | .. | 3 5 9 |
| 60,000 | ,, | ,, | 7½ | Do. G, 7½ p. c. do. | 212—217 | .. | 3 9 1 |
| 1,300,000 | ,, | ,, | 7 | Do. H, 7 p. c. max. | 207—212 | .. | 3 6 0 |
| 463,000 | ,, | ,, | 10 | Do. J, 10 p. c. Prf. | 305—315 | .. | 3 3 6 |
| 476,000 | ,, | ,, | 6 | Do. K, 6 p. c. Prf. | 173—178 | .. | 3 7 5 |
| 1,061,150 | ,, | 12 June | 4 | Do. 4 p. c. Deb. Stk., | 138—143 | .. | 2 15 11 |
| 294,850 | ,, | ,, | 4½ | Do. 4½ p. c. do. | 150—155 | —3 | 2 18 0 |
| 908,000 | ,, | ,, | 6 | Do. 6 p. c. do. | 207—212 | .. | 2 16 7 |
| 70,000 | 10 | 14 May | 6 | Hongkong & China Limited | 12—13 | .. | 4 12 4 |

| Issue. | Share. | When ex-Dividend. | Dividend or Dividend & Bonus. | NAME. | Closing Prices. | Rise or Fall in Wk. | Yield upon Investment. |
|---|---|---|---|---|---|---|---|
| £ | | | p. c. | GAS COMPANIES. | | | £ s. d. |
| 3,800,000 | Stck. | 14 May | 12 | Imperial Continental | 225—235 | —19½ | 5 2 1 |
| 376,400 | 100 | 1 Aug. | 4 | Do. 4 p. c. Debs. Red. | 100—103 | .. | 3 17 8 |
| 473,600 | Stck. | 13 Aug. | 3½ | Do. 3½ p. c. Deb. Stk ,, | 108—110 | .. | 3 3 8 |
| 75,000 | 5 | 26 June | 6 | Malta & Mediterranean, Ltd. | 6—6½ | .. | 4 12 4 |
| 560,000 | 100 | 1 Oct. | 5 | Met. of Melbourne, 5p. c. Deb. | 113—116 | .. | 4 6 2 |
| 250,000 | 100 | ,, | 4½ | Do. 4½ p. c. Debs. | 108—110 | .. | 4 1 10 |
| 541,920 | 20 | 12 June | 5 | Monte Video, Limited | 16½—17½ | .. | 5 14 3 |
| 150,000 | 5 | 29 May | 8 | Oriental, Limited | 8½—9 | +¼ | 4 8 11 |
| 135,000 | 5 | ,, | 8 | Do. New, £4 10s. paid | 7¼—7¾ | .. | 4 12 10 |
| 15,000 | 5 | ,, | 8 | Do. do. 1879, £1 paid | 1¾—2 | .. | 4 0 0 |
| 60,000 | 5 | 16 Sept. | 7 | Ottoman, Limited | 5—5½ | .. | 6 7 3 |
| 420,000 | 100 | 1 May | 6 | People's Gas } 1st Mtg. Bds. | 105—110 | .. | 5 9 1 |
| 500,000 | 100 | 1 June | 6 | of Chicago } 2nd Do. | 102—107 | .. | 5 12 1 |
| 250,000 | 10 | 30 Sept. | 10 | San Paulo, Limited | 13½—14½ | .. | 6 18 0 |
| 5,475,000 | Stck. | 13 Aug. | 5 7/10 | South Metrop., 4 p.c. Ord. | 143—148 | —1 | 3 10 3 |
| 820,000 | ,, | 15 July | 5 | Do. 5 p. c. Deb. Stk. | 170—173 | —3 | 2 17 9 |
| 60,000 | Stck. | 16 Sept. | 11½ | Tottenham & Edmonton, A | 265—275 | .. | 4 3 7 |
| 60,000 | ,, | ,, | 8½ | Do. B | 180—190 | .. | 4 9 5 |
| 170,380 | 10 | 29 May | 10 | Tuscan, Limited. | 13½—14½ | .. | 6 18 0 |
| 149,900 | 10 | 1 July | 5 | Do. 5 p. c. Debs. Red. | 100—102 | .. | 4 18 0 |
| | | | | WATER COMPANIES. | | | |
| 746,123 | Stck. | 26 June | 10½ | Chelsea, Ordinary | 340—345 | —3 | 2 19 5 |
| 150,000 | ,, | ,, | 5 | Do. 5 p. c. Pref. | 177—182 | .. | 2 14 11 |
| 160,000 | ,, | ,, | 4½ | Do. 4½ p. c. Pref. Stk., 1875 | 160—164 | .. | 2 14 10 |
| 175,785 | ,, | 30 Sept. | 4½ | Do. 4½ p. c. Deb. Stock | 162—167 | .. | 2 13 11 |
| 1,719,514 | Stck. | 15 Oct. | 7 | East London, Ordinary | 215—220* | —7 | 3 3 8 |
| 654,740 | ,, | 26 June | 4½ | Do. 4½ p. c. Deb. Stk. | 163—168 | .. | 2 13 7 |
| 225,000 | ,, | ,, | 3 | Do. 3 p. c. Deb. Stk. | 105—107 | .. | 2 16 1 |
| 700,000 | 50 | 12 June | 7½ | Grand Junction, 10 p.c. max. | 115—120 | —4½ | 3 2 6 |
| 295,000 | Stck. | 30 Sept. | 4 | Do. 4 p. c. Deb. Stk. | 150—155 | .. | 2 11 7 |
| 708,000 | Stck. | 13 Aug. | 12 | Kent | 340—350 | —4½ | 3 8 9 |
| 160,000 | ,, | ,, | 7 | Do. New, 7 p. c. max. | 217—222 | .. | 3 3 0 |
| 1,043,800 | 100 | 26 June | 7½ | Lambeth, 10 p. c. max. | 255—260 | —2½ | 2 17 8 |
| 406,200 | 100 | ,, | 7½ | Do. 7½ p. c. max. | 225—230 | .. | 3 5 2 |
| 350,000 | Stck. | 30 Sept. | 4 | Do. 4 p. c. Deb. Stk. | 148—153 | .. | 2 12 3 |
| 500,000 | 100 | 13 Aug. | 12 9/10 | New River, New Shares | 418—423 | —10 | 3 1 0 |
| 1,000,000 | Stck. | 30 July | 4 | Do. 4 p. c. Deb. Stk. | 150—155 | .. | 2 11 7 |
| 902,300 | Stck. | 12 June | 4 | S'thwk & V'xhall, Ordinary | 154—159 | .. | 2 10 4 |
| 126,500 | 100 | ,, | 4 | Do. Do. 7½ p. c. Max. | 150—155 | .. | 2 11 7 |
| 489,200 | Stck. | ,, | 5 | Do. Do. 5 p. c. Pref. | 175—180 | .. | 2 15 6 |
| 1,019,585 | ,, | 30 Sept. | 4 | Do. 4 p. c. A Deb. Stk. | 148—152 | .. | 2 12 7 |
| 1,155,066 | Stck. | 12 June | 10 | West Middlesex | 320—325 | —5 | 3 1 6 |
| 200,000 | ,, | ,, | 4½ | Do. 4½ p. c. Deb. Stk. | 165—170 | .. | 2 12 11 |

*Ex div.

**Sulphate of Ammonia** is in a very depressed condition. Buyers are now offering as low as £6 15s. for northern ports; while for other ports the price varies from £6 17s. 6d. to £7 2s. 6d., less 3½ per cent.

## COAL TRADE REPORTS.

### From Our Own Correspondents.

**Lancashire Coal Trade.**—The position here shows a gradual improvement; and with the increased quantities now going away for gas-making and house-fire purposes, collieries are getting nearly on to full time—four to five days per week being the general average. The better qualities of round coal are in fair demand, and prices show a hardening tendency; but there is no actual advance. Prices remain at about 10s. to 10s. 6d. per ton at the pit for best Wigan Arley; and 8s. to 8s. 6d. for Pemberton four feet and seconds Arley. The lower classes of round coals are not quite so plentiful; but supplies are still in excess of requirements, with prices, through rather steadier, still ruling at 6s. to 6s. 6d. per ton at the pit. The better qualities of engine fuel move off readily, with slight advances on forward contracts; but common sorts continue plentiful, and are obtainable at extremely low figures. A fair weight of business comes forward in the shipping trade; but prices are without improvement.

**Northern Coal Trade.**—Though there has been a decided increase in the shipments of coal during the last few days, yet the demand is a very irregular one. The Northumbrian collieries are only poorly employed at the present time; but those south of the Tyne meet with an increasing demand for coal which is very satisfactory. Best steam coals are dull at 7s. 9d. per ton f.o.b.; while second qualities are about 7s. 3d. per ton. In the gas coal trade, there is the enlarged demand that is usual at this time of the year, both for the local and southern trades; and shipments this week are far above an average. For single cargoes, the price quoted is now from 6s. 6d. to 7s. per ton f.o.b.; but the bulk of the deliveries are on old contracts. Gas coke is now enlarging in production; and as the demand does not increase so rapidly, the stocks are in some cases being enlarged. There is no alteration in the price of gas coke this week; but some of the companies are endeavouring to dispose of more for house consumption in their districts. In one instance, 6s. 8d. per ton at the works is advertised as the price.

**Scotch Coal Trade.**—Very little change has been experienced during the week. The foreign trade has received a slight check by the rise in freights; and the home consumption has been considerably increased by cold weather. Prices remain the same. The quotations are: Main, 6s. 3d., and ell 6s. 9d. to 7s. 3d. per ton, f.o.b. Glasgow. The shipments amounted to 150,877 tons—a decrease on the quantity in the preceding week of 9060 tons, and on the corresponding week of last year of 196 tons. For the year to date, the total shipments have amounted to 6,277,211 tons—an increase over the quantity in the corresponding period of last year of 225,979 tons.

**Holyhead and North Wales Gas and Water Corporation, Limited.**—At a meeting of the Directors of this Corporation, held on the 23rd inst., an interim dividend was declared for the six months ending Oct. 1, at the rate of 6 per cent. per annum upon the share capital.

**Proposed Extension of the Heywood Gas-Works.**—The Corporation of Heywood have decided to apply to the Local Government Board for powers to borrow £20,000 for the extension of their gas-works. The works now occupy the whole of the ground originally set apart for the undertaking; and the Town Council having entered into negotiations for the acquisition of additional land, further borrowing powers are necessary.

**Water-Gas Plant at Hoylake.**—The installation of carburetted water-gas plant which Messrs. Humphreys and Glasgow have erected at the gas-works of the Hoylake and West Kirby Gas and Water Company, Limited, was formally opened last Thursday by the Chairman (Dr. J. Kellett Smith). At a luncheon which was subsequently served at the Stanley Hotel, Dr. Smith said the Company's great difficulty had been want of space; and long ago their late Manager (Mr. W. Yates) and himself had talked about taking up the manufacture of carburetted water gas. When the need became greater, owing to the rapid extension of their district of supply, he made the suggestion to the present Manager (Mr. J. Dougall); and the result was that they entered into a contract with Messrs. Humphreys and Glasgow. He believed this was the first water-gas plant introduced into Cheshire; and he wished to say that the Contractors had carried out the work with the utmost exactitude.

**The Proposed Purchase of the St. Anne's Gas-Works by the Local Authority.**—A special meeting of the St. Anne's-on-the-Sea District Council was held last Thursday, for the purpose of considering the promotion of a Bill next session which will give them power to acquire the undertaking of the local Gas Company. The Clerk explained the negotiations which had taken place. The Directors of the Company not only refused to treat for the sale of the works, but would not allow the Engineers appointed by the Council to report as to the value of the undertaking (Messrs. Stevenson and Burstal) to make an inspection. Consequently, they were only able to inspect the works from the outside. They reported that the structures appeared to be in fair condition, and some absolutely new. The valuation had doubled in six years. Dealing with the finances of the concern, the Engineers reported that since 1880 the Company had exceeded their powers, and had been acting illegally. The capital was fixed at £15,000, and they could not borrow; yet in 1880 they created a mortgage loan of £5000, and in that year the capital expenditure was more than the total amount authorized. In 1895, the capital account exceeded £23,000; and, in the opinion of the experts, the Company had been acting *ultra vires* almost from the formation of the concern. They expressed the opinion that Parliament would readily pass a Bill for its purchase by the Local Authority. It was resolved to promote a Bill for the acquisition of the works.

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**Burnham Water Company.**—The Directors of this Company have been authorized by the shareholders to increase the capital to the extent of £3000 by the creation of £1 shares, to be entitled to a dividend of 4 per cent. per annum. Part of the money is required for the purpose of extending the distribution system.

**Killamarsh Gas Company, Limited.**—A meeting of this newly-formed Company has been held. The Secretary (Mr. Fisher) announced that the amount of shares applied for was £3281. The question of a site for the works was discussed; and an offer of about 4 acres of land (adjoining the East to West Railway), at £40 per acre, was accepted.

**The Water Question at Eastbourne.**—A meeting of owners and ratepayers of Eastbourne was held on the 15th inst. to consider the subject of the water supply of the town. The Mayor (Alderman J. A. Skinner, J.P.) presided, and submitted a resolution that a Bill should be promoted next session to enable the Corporation to acquire the Water Company's undertaking. After discussion, this was carried; and a poll of the inhabitants is to be taken on the question.

**New Issues of Stock.**—The following new issues of stock are announced: South Metropolitan Gas Company, £30,000 of 5 per cent. perpetual debenture stock, at a minimum price of £172 per cent. Brentford Gas Company, £30,000 of new stock. Wandsworth and Putney Gas Company, £8000 of new ordinary 7 per cent. stock (by auction). Maidstone Gas Company, £14,000 of 3 per cent. perpetual debenture stock, at a minimum price of £100 per £100 of stock.

**The Water Supply of Birmingham.**—Although so much rain has fallen during the last few weeks, the storage of water at the reservoirs belonging to the Birmingham Corporation was, at the beginning of last week, below the normal quantity. The long period of drought in the early part of the year considerably reduced the storage; and the heavy rains of the last two months have only added about six full days' supply. At the present time another 50 million gallons are required in the Shustoke reservoir; and the Water Committee will not be relieved of the anxiety felt during the summer until the reservoirs are full. They are storing from day to day, and are not using all the water yielded by the rivers; so that, with a continuance of rainy weather, it is expected that the reservoirs will soon be replenished.

**Torquay Corporation Water-Works.**—From the recently published accounts of the Torquay Corporation, it appears that in the last financial year the total revenue of the water-works was £12,916; and the expenditure, £12,225—leaving a net surplus of £691. The income included £7419 from water-rents in the borough, £1541 from St. Marychurch, £1213 from Cockington, and £2166 from Newton Abbot. On the expenditure side, maintenance charges amounted to £6771, including £1111 for repairs to reservoirs, £1323 for other repairs, £643 for salaries, and £1019 part cost of a main to Warberry. The contribution to the interest and redemption fund of the stock debt account was £4682; and £441 was paid as part of the cost of the scheme for the purchase of the watersheds to which reference was made last week.

**New Water-Works for Daventry.**—Messrs. Eunson and Williams have reported to the Daventry Town Council on a scheme for providing a new supply of water for the town. The estimated cost of constructing the works is placed at £5263, exclusive of land and any other outside expenses.

**The London County Council's Costs in Connection with Water Bills.**—At the meeting of the London County Council last Tuesday, it was resolved to refer to the Finance and Parliamentary Committees the question of preparing and submitting a return of the expenses incurred by the Council in promoting and opposing Water Bills since their formation.

**The Holyhead District Council and the Water-Works.**—Last Tuesday evening, a specially convened meeting of the Holyhead District Council was held, to consider the question of putting into force a resolution of a previous meeting to purchase the water-works by obtaining compulsory powers by a Private Act, as the Water Company declined to sell. It has been discovered that it would be almost impossible to get an Act during next session; and it was agreed to proceed with the matter in the session of 1898.

**The Proposed Purchase of the Gravesend Water-Works by the Corporation.**—A special meeting of the Gravesend Town Council was held last Wednesday to consider the proposal to purchase the Gravesend and Milton Water Company's undertaking. The Town Clerk read a letter from the Secretary of the Company, stating that, in the opinion of the Directors, the sum of £120,000 offered was not sufficient to justify them in calling a meeting of the shareholders to consider the proposal of the Corporation. The Mayor (Mr. T. Layborn) said, from figures which had come under his notice, he thought, if an arbitrator were appointed, the water-works could be acquired at a price that would not cost the town anything out of the rates. Mr. Berkowitz moved that the Council should promote a Bill next session to obtain powers to purchase the undertaking, and construct further works for the improvement of the present supply. Alderman Russell seconded the motion, and other support was given to it. Mr. Sandford argued that if the Council bought the undertaking for £120,000, it was impossible for them to carry it on so cheaply as private individuals. Mr. Clarke said that at Reading the water-works belonged to the town, and, after all the outgoings, there was a sum of £2000 for relieving the rates every year. The Mayor said the purchase could be effected by payments out of the revenue derivable from the supply, so that in sixty years the town would have the benefit of the entire water-rent, which would then probably amount to £5000 or £6000 a year. This upon the 3 per cent. table, representing principal and interest, would mean an annual sum of £5420. The total income of the Company last year was £9032; and the amount expended, £4099—leaving a balance of £4933. Adding to this the £546 paid to the Directors, which would be saved if the Corporation had the works, the total would be £5479. The annual amount of principal and interest being £5420, a present profit of about £59 a year to the Corporation would be left. The motion was carried by a large majority.


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**Sales of Shares and Stock.**—Last Tuesday, £325 of "A" stock of the Croydon Gas Company changed hands at £1090; and two original £25 shares in the Chelmsford Gas Company realized £39 each. On Thursday, a parcel of original stock in the Leighton Gas Company was sold by auction, when three lots of £20 realized £45 each, and a fourth lot £46; while a £14 share fetched £30, and £21 of original stock, with about nine months' accrued dividend at the rate of 8 per cent. per annum, was knocked down at £47.

**Georgetown Gas Company, Limited.**—The earnest efforts which the Directors and officials of this Company are making to secure a return to former prosperity are meeting as yet with little encouragement. The recently issued accounts show that the revenue for the half year to June 30 amounted to only £1929, while the expenditure was £1803—leaving a small balance of £126 to carry to the net revenue account. After adding the amount brought forward from the previous half year, and deducting interest on bonds, &c., the available sum is £136, out of which the Directors recommend the payment of a dividend on the preference share capital at the rate of 8 per cent. per annum.

**Oil Gas Enrichment Company, Limited.**—The third annual general meeting of this Company will be held next Thursday, in Edinburgh, when the Directors will report that for the period of fifteen months from July 1, 1895, to Sept. 30, 1896, the balance at the credit of the profit and loss account was £582. This they recommend to be disposed of as follows: Payment of a dividend on the preference shares, £312 10s.; one-third of balance of £487 10s. of preliminary expenses to be written off, £162 10s.—together, £475. This will leave £107 to be carried forward. The Directors remark that the Peebles process has continued, notwithstanding the present low price of cannel coal and the rise in the price of oil, to give satisfactory results, and has been introduced into several new works.

**The Relative Working Cost of Oil and Gas Engines.**—The Drainage Committee of the Easthampstead District Council have in hand some additions to the works under their charge. Further pumping power is required; and the Engineer under whose advice the Committee are acting (Mr. Radford) recommended them to adopt gas-engines instead of oil-engines, on the ground that, although the former are rather more expensive than the latter, they are less complicated, less liable to get out of order, more easily worked, and a higher power can be obtained. The Committee were not altogether in favour of accepting this advice, as Crossley oil-engines, of which they have had experience, have, in their opinion, so far worked satisfactorily. At the last meeting of the Council, one of the members stated that he had had an interview with the makers of the Priestman oil-engines; and they had written to him regarding the relative cost of oil and gas engines to this effect: "The new type 2-horse power engines, driven by gas, are less complicated than oil-engines and more powerful; but taking the price of gas at 4s. per 1000 cubic feet, and oil at 6d. per gallon, the cost of driving gas-engines would be 25 per cent. in excess of oil-engines." By a majority of one, the Council decided in favour of oil-engines, and resolved that Messrs. Crossley fix two duplicate engines of the pattern already in use.

**Extensive Leakage of Gas at Selby.**—An extraordinary leakage of gas has lately been troubling Mr. M. Dunn, the Engineer and Manager of the gas-works of the Selby District Council. At the last meeting of the Council, he reported that on the night of the 12th inst. he was called to trace a serious escape of gas at the house of a resident. It being dark, he could not then do anything; but on the following morning, he commenced a thorough investigation. On laying the main bare near the house, an old brick culvert was discovered in which a large quantity of gas had accumulated. Where it had come from was the puzzle. That there was very considerable loss of gas going on was manifest by the record at the works, as in a very short time the output went up to the extent of 40,000 cubic feet. On the 13th nearly the whole of the stock of gas was consumed; and the greatest economy had to be exercised with what was available. Mr. Dunn expressed the opinion that the town was undermined with culverts and disused sewers. Operations were continued till the 18th, when the workmen came upon an old branch main from the gas-works, which had apparently been stopped off many years ago at a considerable distance from the trunk main; but no indication of this, or any note on the matter, seems to have been put upon the plan of the mains. Mr. Dunn was at once satisfied that this disused pipe was the source of all the trouble; and he very promptly disconnected it near the main, and had it securely plugged. The remedy was effectual. During the five days' search, the day supply of gas had to be discontinued between ten and three o'clock, in order to meet the night demand. But the discovery of the source of the leakage enabled the full service to be restored. It is estimated that something like 50 per cent. of the gas made was unconsumed—not only causing inconvenience and loss, but danger to life and property.

**The Quality of the East London Water Supply.**—In August last, complaint was made as to the quality of the water supplied to Limehouse; and a sample taken from the house of a resident was submitted to analysis. At the meeting of the District Board last Wednesday, a letter, accompanied by a report from Messrs. Crookes and Dewar, was received from the Local Government Board, in which they remarked that the report completely disposed of the allegation as to the impurity of the water, and that any defect must have arisen from local causes, otherwise the whole of the water sent out to the consumers must have been equally bad.

**Messrs. Gwynne and Co. and their Employees.**—A few weeks ago, a strike took place at the works of Messrs. Gwynne and Co., owing to an attempt by the Amalgamated Society of Engineers to dictate to them what men they were to employ. The firm were successful in replacing all the men called out; among the new hands engaged being a number of first-class mechanics supplied by the National Free Labour Association. At present there are actually many more hands at work than there were before the strike. At the Clerkenwell Police Court, last Friday, two men named Newton and Gardiner were summoned for intimidating Matthew Smith, an engineer, with a view to compelling him to abstain from working for Messrs. Gwynne, and they were bound over in £10 to keep the peace towards him for three months.

**The London County Council and the Gas Supply to Artizans' Dwellings.**—The Committee of the London County Council who are entrusted with matters concerning the housing of the working classes lately submitted to the Finance Committee certain supplementary estimates in connection with the Boundary Street scheme of artizans' dwellings. The total amount is £2520; and it represents, among other things, the extra cost of the buildings arising from the supply of gas-fittings and automatic prepayment meters to each tenement. In presenting these estimates to the Council, the Finance Committee said they understood the Housing Committee intended to propose that a supply of gas should be obtained in bulk, and retailed at a price sufficient to cover both cost and annual charges for interest on, and repayment of, the capital expended by the Council on the fittings.

**St. Marychurch Gas-Works.**—A resolution authorizing the repayment of a portion of the mortgage debt upon the gas-works was submitted to the St. Marychurch District Council at their last meeting. Mr. W. H. Grant, the Chairman of the Gas Committee, said that, including the £4000 now to be dealt with, there had been paid off £5500 of the loan on account of the gas-works; reducing the debt of £12,000 to £7000. The amount paid off was considerably more than the original cost of the works, which had been improved to such an extent that, if placed on the market at once, they would realize £25,000 or £30,000; while in view of future developments, and of the fact that the works were a monopoly, he did not know whether they would not fetch £40,000. He added that it would not be long before they would be in a position to reduce the price of gas to the consumers.

**The Proposed Purchase of the Fylde Water-Works by the Local Authorities.**—In connection with the proposed purchase of the Fylde Water-Works by the Local Authorities, a Committee representative of the latter are busy collecting information regarding the undertaking. If the works are to be purchased by Act of Parliament, the notice for the Bill must, of necessity, be given next month. It is not yet known whether the shareholders will be bought out or will continue to receive their customary dividends of 10, 7, and 4 per cent. respectively. It is a noticeable fact that the shares continue at a very high premium. The half-yearly report of the Directors of the Company has just been issued. It shows a balance of £16,868 available for division. The Directors recommend dividends of 4 per cent. per annum on the preference stock (1891), 10 per cent. on the "A" stock, and 7 per cent. on the "B" stock; leaving a balance of £7213 to be carried forward.

**Incandescent Gas Lighting and the Ironmongery Trade.**—A recent number of "The Ironmonger" contains the following editorial paragraph: "The remarkable advances which have been made during the past two years or so in respect of incandescent gas lighting have been the means of giving ironmongers a great deal of work in that line. But, on the other hand, the general preference shown by the public for the incandescent system has placed many ironmongers in a rather awkward predicament. It has left them with more or less considerable stocks of chandeliers, brackets, and so on, which do not seem to be capable of being easily adapted to the use of the incandescent fittings. In numerous instances, no particular difficulty has been experienced in using the incandescent burners, &c., upon ordinary gas-fittings; but in other cases, the difficulty has proved to be serious, with the broad result that some of our retail friends have stock of this kind on hand which they do not exactly know how to clear out." Our contemporary is unable to say whether or not the difficulty here indicated is at all widespread, or if the cases that have been reported are exceptional, and, therefore, not of great moment to the trade as a whole.

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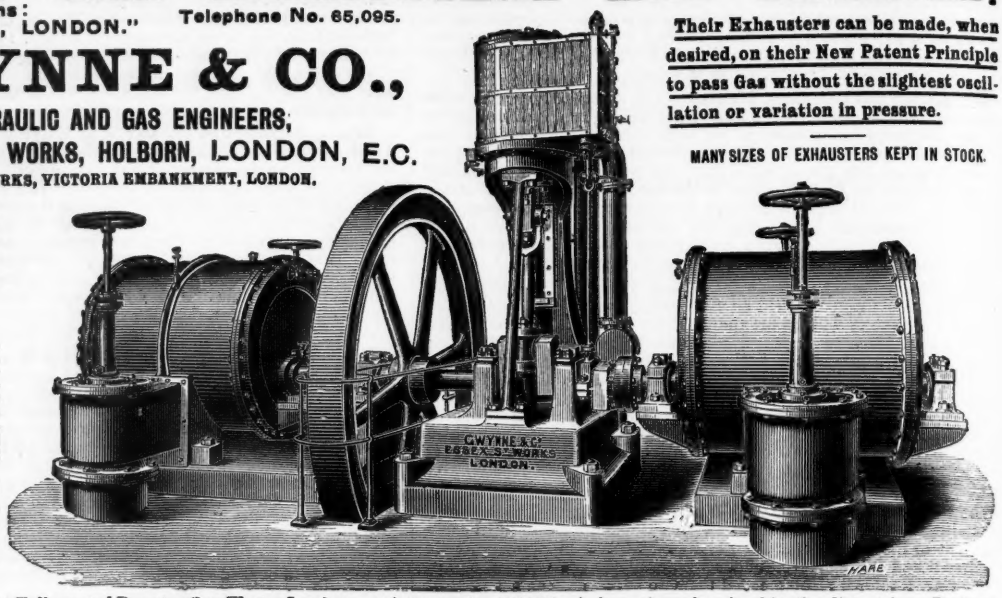


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Applications (with *copies only* of Testimonials), stating Age and Wages required, to Mr. TROUGHTON, Gas-Works, NEWMARKET.

LONGWOOD GAS COMPANY, NEAR HUDDERSFIELD.

**WANTED, a Competent Man to repair** and fix Meters. Preference given to one who can lay Mains and Services.
Applications, with *copies* of not more than three Testimonials, stating Wages required, to be addressed to J. H. BREARLEY, Secretary and Manager, not later than Saturday, Oct. 31, 1896.

SULPHATE OF AMMONIA SATURATORS.

**JOSEPH TAYLOR & CO.**, Chemical Plumbers, &c., and Makers of every description of Solid Plate Lead and Timber Cased Saturators, &c. CENTRAL PLUMBING WORKS, TOWN HALL SQUARE, BOLTON. Special Attention to Repairs.
Before placing Orders, please write for Estimate.

CANNEL, COAL, ETC.

**JOHN ROMANS & SON, EDINBURGH,**
Gas Engineers, supply all the most approved SCOTTISH CANNELS; also FIRE-CLAY GOODS, CAST-IRON PIPES, and other APPARATUS for GAS and WATER WORKS.
Prices, &c., will be forwarded on application to No. 80, ST. ANDREW SQUARE, EDINBURGH, or NEWTON GRANGE, NEWBATTLE, DALKEITH, } SCOTLAND.

*Fourth Edition, Revised and Enlarged.*

**DESTRUCTIVE DISTILLATION: A** Manualette of the Paraffin, Coal Tar, Rosin Oil, and kindred Industries. By PROFESSOR E. J. MILLS, D.Sc., F.R.S. *Imp. 8vo., 5s.*
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**It is Worth Your While to Buy** DIRECT.
THE RELIANCE LUBRICATING OIL COMPANY SUPPLY on APPROVAL "RELIANCE" NON-CORROSIVE LUBRICANTS (which, through their superiority, have the largest sale in the world)—viz., Engine, Cylinder, and Machinery Oils, 11½d.; Spindle Oil, 8½d.; Gas-Engine and Dynamo Oils, 1s. 6d. per gallon; Barrels Free and Carriage Paid. Also Liquids for Gas Making, Enriching, &c.
RELIANCE LUBRICATING OIL COMPANY, WATER LANE, GREAT TOWER, LONDON, E.C.
Depôts at Liverpool, Bristol, Hull, Glasgow and Newcastle-on-Tyne. Telegrams: "Subastral, London."

**WANTED**, by an old-established Firm, a TRAVELLER or AGENT, well acquainted with General and Builders' Ironfounders' Work. One with a good London connection, and with a knowledge of Gas Apparatus preferred.
State Terms and full Particulars to No. 2732, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

MERTHYR TYDFIL GAS COMPANY.

ASSISTANT CLERK.

**WANTED, a Young Man as Assistant** CLERK. Must be Experienced in the Accounts of a Gas Office.
Applications, in own Writing, stating Age, Experience, and particulars of last Employment, and enclosing *copies only* of not more than three recent Testimonials, to be endorsed "Assistant Clerk," and addressed to the undersigned not later than Saturday, the 31st inst. Salary £78 per annum.
JOHN L. COCKER,
Secretary and General Manager.
Gas Offices: Gas-Works,
Merthyr Tydfil, Glamorganshire,
Oct. 15, 1896.

**WANTED, a Works Manager for a Company** manufacturing Prepayment Gas-Meters.
Apply, by letter, stating Experience, Age, and Salary required, to the LIVERPOOL METER COMPANY, LIMITED, Tower Chambers, LIVERPOOL.

**WANTED, a Gas-Fitter, well up in Iron** and Compo., to fix Gas Fires and Cookers, House Fittings, and for Meter Inspecting. None but reliable Men need apply.
State Age and Wages required, and enclose *copies* of Testimonials to JAMES DONALDSON, Secretary and Manager, Gas-Works, TONBRIDGE.

**FOUR Tar-Tanks to be Let on Hire for** the Winter Months.
Apply to No. 2734, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

**OIL-GAS BENZOL for Enriching Coal** Gas. A few Thousand Gallons to dispose of.
Apply, by letter, in the first place, to No. 2714, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

**THE Birstall District Council are prepared** to receive TENDERS for the purchase of the surplus TAR and AMMONIACAL LIQUOR (the latter at 4°, 4½°, 5°, 5½°, and 6° by Twaddel's Hydrometer respectively), made by them at their Gas-Works, Birstall, adjoining the L. & N.W. Railway, for One, Two, or Three Years.
Tenders, stating price per ton for each article, and for the Liquor at each strength, sealed and endorsed, must be sent to me not later than Monday, Nov. 2, 1896.
The successful Contractor will, at his own expense, have to enter into an Agreement and Bond with and to the Council for the due performance of his Contract.
The District Council do not bind themselves to accept the highest or any tender.
For further Particulars, apply at the Gas-Works, or to
WM. MIDDLEBROOK, Solicitor,
Clerk to the Council.
Council Offices: Birstall, near Leeds,
Oct. 17, 1896.

## CORPORATION OF LEICESTER.

RETORTS AND FIRE-BRICKS.

**THE Gas and Electric Lighting Committee** of the above Corporation are prepared to receive TENDERS for the supply and delivery of RETORTS and FIRE-BRICKS.
Specification, Quantities, and Form of Tender can be obtained from the Engineer.
Tenders, addressed to Alderman Lennard, Chairman, and endorsed "Tender for Retorts, &c.," to be delivered at these Offices not later than Eleven o'clock a.m., on Saturday, Nov. 7, 1896.
The Committee do not bind themselves to accept the lowest or any tender.
ALFRED COLSON, M.Inst.C.E.,
Engineer and Manager.
Offices: Millstone Lane,
Leicester, Oct. 17, 1896.

## BRENTFORD GAS COMPANY.

SALE BY TENDER OF £30,000 NEW STOCK, 1881.

**IN Pursuance of the Brentford Gas Order,** 1881, NOTICE IS HEREBY GIVEN, that it is the intention of the Directors of this Company to sell BY TENDER £30,000 of NEW STOCK, 1881, of the Company, to be paid up in full on or before the 1st day of December next, such Stock being a portion of Additional Capital authorized to be raised by Resolutions passed at an Ordinary Meeting of Proprietors, held on the 21st day of February, 1890, under the Powers of the above-mentioned Order.
Particulars and Conditions of Tender may be obtained on application at this Office; and sealed tenders must be sent in not later than Twelve o'clock (Noon) on Monday, the 16th day of November next.
By order,
WM. CROXFORD,
Secretary.
Office: Brentford Gas Company,
Brentford, Oct. 16, 1896.

## MAIDSTONE GAS COMPANY.

SALE BY TENDER OF £14,000 THREE PER CENT. PERPETUAL DEBENTURE STOCK.

MINIMUM PRICE, £100 PER £100 STOCK.

**NOTICE is Hereby Given, that it is the** intention of the Directors of this Company to sell BY TENDER £14,000 of THREE PER CENT. PERPETUAL DEBENTURE STOCK, in accordance with the Provisions of the Maidstone Gas Order, 1896.
The Capital of the Company is £92,958.
Dividends from 1887 to 1896 have been 10½ to 11 per cent. per annum.
The Debenture Stock will rank before the whole of the Company's authorized Share Capital.
Particulars of same, with Form of Tender, can be obtained on application to the undersigned; and tenders must be delivered at the Company's Offices, Gas-Works, Maidstone, on or before Ten o'clock in the Forenoon on Thursday, the 19th day of November next.
The Stock will be allotted to the highest bidders; but no tender will be accepted at a lower price than at the rate of £100 money for each £100 Debenture Stock.
By order,
HOAR, HOWLETT, AND TATHAM,
Clerks to the Company.
9, King Street, Maidstone,
Oct. 21, 1896.

## SOUTH METROPOLITAN GAS COMPANY.

SALE BY TENDER OF £30,000 FIVE PER CENT. PERPETUAL DEBENTURE STOCK.

MINIMUM PRICE £172 PER CENT.

**NOTICE is Hereby Given, that it is the** intention of the Directors of this Company to SELL BY TENDER £30,000 of FIVE PER CENT. PERPETUAL DEBENTURE STOCK, in accordance with the Provisions of the South Metropolitan Gas Act, 1882.
Particulars of same, with Form of Tender, can be obtained at this Office, on application to the undersigned; and Tenders must be sent in on or before Saturday, the 31st day of October inst.
The Stock will be allotted to the highest bidders; but no tender will be accepted at a lower Price than at the rate of £172 money for each £100 Debenture Stock.
By order,
FRANK BUSH,
Secretary.
Offices: 709A, Old Kent Road, S.E.,
Oct. 17, 1896.

## CEARA GAS COMPANY, LIMITED.

**NOTICE is Hereby Given, that the** ORDINARY ANNUAL GENERAL MEETING of the Shareholders will be held at the Offices of the Company, 9, Queen Street Place, Cannon Street, in the City of London, on Friday, the 30th day of October, at One o'clock in the Afternoon, to receive the Report of the Directors, to declare a Dividend, and for general purposes.
By order of the Board,
THOMAS GUYATT,
Secretary.
Oct. 16, 1896.

## COLONIAL GAS ASSOCIATION, LIMITED.

**NOTICE is Hereby Given, that the** EIGHTH ANNUAL GENERAL MEETING of the Colonial Gas Association, Limited, will be held at the Offices of the Company, St. Clement's House, Clement's Lane, Lombard Street, in the City of London, on Tuesday, the 3rd day of November, 1896, at Three o'clock in the afternoon, to receive the Report of the Directors and Statement of Accounts, to declare a Dividend, to elect Directors, and to elect Auditors.
The TRANSFER BOOKS of the Association WILL BE CLOSED from the 3rd of November to the 6th of November, 1896, both days inclusive.
By order of the Board,
S. SPENCER,
Chairman.
Oct. 19, 1896.

ISSUE OF STOCKS AND SHARES BY AUCTION UNDER PARLIAMENTARY POWERS.

**MR. ALFRED RICHARDS undertakes** the issuing by Auction of GAS AND WATER SHARES under Parliamentary Powers.
He also holds MONTHLY SALES of GAS AND WATER SHARES at the Auction Mart, Tokenhouse Yard, E.C.
Terms for the issuing of Capital, and also for offering to auction Gas and Water Shares, and all Particulars relating thereto, may be had of Mr. Alfred Richards.
Offices: 18, FINSBURY CIRCUS, E.C.

*Now Ready, Price 15s., Limp Cloth, the Sixteenth Yearly*

# ANALYSIS OF THE ACCOUNTS
OF THE
# Metropolitan Water Companies,

Chelsea, East London, Grand Junction, Kent, Lambeth, New River, Southwark and Vauxhall, and West Middlesex—showing the Capital, Income, Expenditure, Profits, and Dividends per Million and per Thousand Gallons of Water supplied; the proportion of Expenditure and Profits to Gross Income; and the Income, Expenditure, and Profits per House, &c., supplied for the Year ended December 31, 1895, or March 31, 1896, together with the quantity of Water supplied, the estimated daily quantity supplied for domestic and other purposes, the quantity supplied per head of population, &c., &c., for the Year ended December 31, 1895.

Compiled and arranged by
**ALFRED LASS, F.C.A.**

LONDON:
WALTER KING, 11, Bolt Court, Fleet Street, E.C.

## UNEQUALLED.

Gas Companies are solicited to try Samples of the

# MIRFIELD
## BLACK BED GAS COAL.

*Prices and Analysis on application.*

**MIRFIELD (GAS-COAL) COLLIERY COMPY.**
**RAVENSTHORPE, NEAR DEWSBURY.**

*Just Published, Crown 8vo., Cloth, 5s. net.*

**INFLAMMABLE GASES:**
**The Detection and Measurement of Inflammable Gas and Vapour in the Air.**
By Professor FRANK CLOWES, D.Sc.,
With a Chapter on PETROLEUM VAPOUR by
BOVERTON REDWOOD, F.R.S.E.

London: CROSBY LOCKWOOD AND SON, 7, STATIONERS' HALL COURT, E.C.

## PRICE'S COKE & COAL BARROW

effects a great saving of time, labour, and expense.
For Particulars, Price, &c., apply to Mr. EDWARD PRICE, 119, Queen's Road, FINSBURY PARK, N.
*Prices are Reduced.*

# THORNLEY GAS COALS
WORKED BY THE
## WEARDALE IRON & COAL Co., Ld.
OUT OF THEIR
THORNLEY AND WHEATLEY HILL COLLIERIES.

**Analysis made by**
**Messrs. J. & H. S. PATTINSON,** *May 28, 1895.*

| | |
|---|---|
| Yield of Gas per Ton . . | 10,500 Cub. Ft. |
| Illuminating Power . . | 16·9 Candles. |
| Coke (of good quality) . . | 67·5 per Cent. |
| Sulphur . . . . . | 0·58 „ |
| Ash . . . . . | 2·73 „ |

**For Price, &c., apply to the**
## WEARDALE IRON & COAL Co., Ld.
QUAYSIDE, NEWCASTLE-ON-TYNE.

# HOLMSIDE GAS COALS.
PRESENT DAILY PRODUCE OVER 4000 TONS.

LATEST ANALYSIS—By CHARLES PHILLIPS, Gas Examiner to Rotherham Corporation.

Yield of Gas Per Ton . . 11,205 Cubic Feet.
Illuminating Power, 16/10 Stand. Sperm. Candl.
Coke (of good & pure quality) 13¾ Cwt. Per Ton.
Sulphur . . . . A little over 1 Per Cent.
Ash . . . . . Under 1 Per Cent.
Tar . . . . . 163 Lbs. (Avoir.) Per Ton.
Ammoniacal Liquor 103 Lbs. (Avoir.) Per Ton.

HOLMSIDE GAS COALS are supplied to the largest Gas Companies in England and on the European Continent; London alone consuming about half the produce.

# SOUTH MOOR PELTON GAS COALS.
PRESENT DAILY PRODUCE AVAILABLE 2500 TONS.

RESULTS OF DIFFERENT ANALYSES:—

Yield of Gas Per Ton . . 10,500 Cubic Feet.
Illuminating Power . 17 Stand. Sperm Candl.
Coke (of excellent quality) . 13¼ Cwt. Per Ton.
Sulphur . . . . . 1·13 Per Cent.
Ash . . . . . 1·34 Per Cent.
Tar . . . . . 180 Lbs. (Avoir.) Per Ton.
Ammoniacal Liquor 94½ Lbs. (Avoir.) Per Ton.

The HOLMSIDE and SOUTH MOOR COALFIELD possesses *a very great quantity of the best Coal;* and, whilst other Coal-Fields are becoming exhausted, this one is only being opened out, so that *the quality* of both the HOLMSIDE COALS, and the SOUTH MOOR COALS *may be relied upon for all practical purposes.*

These Coals may be bought through the Principal Merchants in England, or direct from

## MR. MARK ARCHER,
## HOLMSIDE AND SOUTH MOOR OFFICES,
## NEWCASTLE-UPON-TYNE.

THE INCANDESCENT GAS-LIGHT COMPANY, LIMITED

— *v* —

"DE MARE" COMPANY.

THE INCANDESCENT GAS-LIGHT COMPANY, LIMITED.

— *v.* —

"SUNLIGHT" COMPANY.

THE INCANDESCENT GAS-LIGHT COMPANY, LIMITED HEREBY GIVE NOTICE, as follows:—

VALIDITY. The Company's Patent has been declared VALID ON ALL POINTS after a Fifteen-Day Trial.

NATURE OF INVENTION. The Invention was described by Mr. Justice Wills as a "PIONEER INVENTION."

SCOPE OF PATENT. The Patent HAS BEEN GIVEN A WIDE CONSTRUCTION; and it was held that the protection given by it was not confined to Mantles manufactured according to the particular prescriptions set out in the Specification.

SHAPE OF MANTLE. The Judge held that a Mantle, even if made in a different form or shape (such as the "De Mare" Fringe or Plume), IS STILL AN INFRINGEMENT of the "Welsbach" Patent.

"DE MARE" JUDGMENT. Judgment for an INJUNCTION, WITH FULL COSTS, has been given against the "De Mare" Incandescent Gas-Light System.

"SUNLIGHT" JUDGMENT. Judgment was given AGAINST the "Sunlight" Incandescent Gas-Lamp Company, Limited, on the question of the VALIDITY OF THE PLAINTIFFS' PATENT.

"SUNLIGHT" MANTLES. Last about 100 hours.

"WELSBACH" MANTLES. Last about 1000 hours.

"Sunlight" Mantles BURN DOUBLE THE GAS to produce the same candle power as the Incandescent Gas-Light Company's Mantles.

Users of "Sunlight" Mantles are applying to the Incandescent Gas-Light Company to REPLACE THEM BY THEIR OWN MANTLES.

WARNING. Users of the Incandescent Gas-Light Company's Mantles upon "Sunlight" Burners ARE INFRINGERS OF THE COMPANY'S PATENT, AND WILL BE AT ONCE PROCEEDED AGAINST.

COSTS. Certificates of the Validity of the Company's Patent have been granted both by Mr. Justice Romer and Mr. Justice Wills entitling the Company to Solicitor and Client Costs, which will, IN ALL CASES, BE RIGOROUSLY ENFORCED.

INFRINGERS. The Incandescent Gas-Light Company WILL TAKE PROCEEDINGS AGAINST ALL PERSONS INFRINGING THEIR PATENT WHETHER MAKERS, WHOLESALE DEALERS, RETAILERS, or USERS.

Users of the Company's Mantles upon Burners not sold by the Company ARE INFRINGERS.

"LIMITED LICENSE" WARNING. Judgments have already been obtained against such users from Mr. Justice Chitty, Mr. Justice Stirling, Mr. Justice Kekewich, and Mr. Justice North.

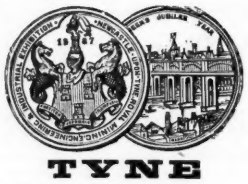
FAITHFULL & OWEN,
11, Victoria Street, Westminster.
Solicitors to the Incandescent Gas-Light Company, Limited.

*April*, 1896.



Awarded HIGHEST MEDAL and DIPLOMA at the Newcastle-on-Tyne Royal Mining and Industrial Exhibition, 1887, for

**CANNEL & COAL.**



**TYNE BOGHEAD CANNEL.**

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| Yield of Gas per ton | 13,155 cub. ft. |
| Illuminating Power | 38·22 candles. |
| Coke per ton | 1,301·88 lbs. |

**EAST PONTOP GAS COAL.**

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| Yield of Gas per ton | 10,500 cub. ft. |
| Illuminating Power | 17·8 candles. |
| Coke | 70 per cent. |

**SOUTH PELAW MAIN GAS COAL.**

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| Yield of Gas per ton | 10,500 cub. ft. |
| Illuminating Power | 16·3 candles. |
| Coke | 73·1 per cent. |

*For Prices and complete Analysis, apply to*

THOS. W. DANCE & SONS,
COAL OWNERS, NEWCASTLE-ON-TYNE;
OR
E. FOSTER & CO.,
12, JOHN STREET, ADELPHI, LONDON, W.C.



**HEBBURN MAIN GAS COALS.**

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| Yield of Gas per ton | 10,500 cub. ft. |
| Illuminating Power | 16·4 candles. |
| Coke | 68 per cent. |

For Prices, f.o.b. Ship or Delivered by Rail, apply to

THE WALLSEND & HEBBURN COAL COMPANY, LTD.
8 Lombard Street, NEWCASTLE-ON-TYNE.
W. RICHARDSON, Fitter.



**THE SILICA FIRE-BRICK COMPANY,**

OUGHTIBRIDGE, near SHEFFIELD,
MANUFACTURE

**SILICA BLOCKS, BRICKS, AND CEMENT**

OF SUPERIOR QUALITY
FOR GAS-FURNACES.

Trade Mark: "SILICA."

These Goods (largely used in Gas, Glass, Iron, and Steel Works) are, on account of their

GREATER DURABILITY,

Strongly recommended where EXCESSIVE HEATS have to be maintained.



**THOMAS TURTON AND SONS, LIMITED,**

SHEAF WORKS, SHEFFIELD,
*MANUFACTURERS OF*

**FILES OF BEST QUALITY**

FOR ENGINEERS.

**STEEL OF ALL DESCRIPTIONS.**

SCREW STOCKS, TAPS AND DIES,
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ANVILS, VICES,
AND ENGINEERS' TOOLS GENERALLY.

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**BOLDON GAS COALS.**

Worked by THE HARTON COAL CO., LTD.

Output about 3000 tons per day.

ANALYSIS—

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|---|---|---|
| Yield of Gas per ton | 10,500 | Cubic Feet. |
| Illuminating Power | 16·9 | Candles. |
| Coke | 66·7 | Coke. |
| Sulphur | 0·86 | Sulphur. |
| Ash | 2·04 | Ash. |

Boldon Gas Coals are supplied under contract to

The Gaslight and Coke Company, South Metropolitan Gas Company, Commercial Gas Company, Imperial Continental Gas Association, European Gas Company, L'Union des Gaz (the Continental Union Gas Company), Crystal Palace District Gas Company, Danish Gas Company, Bombay Gas Company, San Paulo Gas Company, Alliance and Dublin Consumers' Gas Company, Ipswich Gaslight Company, Newcastle Gas Company, Sunderland Gas Company, South Shields Gas Company, and to many other Companies at Home and Abroad.

For Prices, &c., apply to the

HARTON COAL COMPANY, LIMITED,
Newcastle-on-Tyne.
W. H. PARKINSON, Fitter.

# WATER-GAS PLANT

Messrs. S. CUTLER & SONS beg to announce that the CARBURETTED WATER-GAS PLANT erected by them at Hornsey is now in operation; and they have been favoured with the following letter from the Board of Directors.

*Hornsey (Middlesex) Gas Company,*
*Offices: 63, Chancery Lane, W.C.,*
*London, Oct. 16, 1896.*

Messrs. S. CUTLER & SONS,
Providence Iron-Works, MILLWALL, E.

GENTLEMEN,

I am instructed by the Board of Directors of the Hornsey Gas Company to state that the reports of the working of the Water-Gas Plant from the Engineer are most satisfactory, exceeding considerably your contract Specification. The delay has been unfortunate, but that is in no way your fault.

I am, Gentlemen, Yours truly,
S. J. WILLIAMS,
Secretary.

**This Plant includes several new and important features; and Messrs. Cutler invite Gas Engineers who are contemplating the adoption of Water-Gas Plant to favour them with their inquiries.**

**TROTTER, HAINES, & CORBETT,**

**Brettell's Estate**

**FIRE-CLAY & BRICK WORKS,**

**STOURBRIDGE.**

Manufacturers of GAS-RETORTS, GLASSHOUSE FURNACE & BLAST-FURNACE BRICKS, LUMPS, TILES, and every description of FIRE-BRICKS.

Proprietors of

BEST GLASSHOUSE POT & CRUCIBLE CLAY.

Shipments Promptly and Carefully Executed.

London Office: R. Cull, 84, Old Broad St., E.C.

**LONDONDERRY GAS COALS**

FROM THE

**MARQUIS OF LONDONDERRY'S COLLIERIES,**

**COUNTY OF DURHAM.**

Available output up to 5000 tons per day. Yield of Gas 11,000 cubic feet per ton of Coal as per analysis by Mr. John Pattinson, F.C.S., F.I.S.

For Prices and Particulars, apply to

**S. J. DITCHFIELD,**

**SEAHAM HARBOUR, COUNTY OF DURHAM.**

**NEWBATTLE CANNEL.**

**Highest Results in Gas, & Excellent Coke.**

QUOTATIONS ON APPLICATION TO

**THE LOTHIAN COAL COMPANY,**

LIMITED,

NEWBATTLE COLLIERIES,

**DALKEITH, N.B.**

The Cheapest House in the Trade for

**LEVER LOCKS**

FOR

**GAS-METERS.**

**Joseph Oakley & Co.**

Excelsior Works,

WILLENHALL.

**THE DRUM**

**FOR PUMPING AIR, WATER, SEMI-FLUIDS, &c.**

See Advertisement in last and next issue.

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**ALFRETON IRON-WORKS, DERBYSHIRE,**

AND

**Wenlock Iron Wharf, 21 & 22, Wharf Road**

**CITY ROAD, LONDON, N.,**

Manufacture and keep in Stock at their Works (also large stock in London)

PIPES and CONNECTIONS, 1¼ to 48 inches in diameter, and make and erect to order RETORTS, PURIFIERS and TANKS, with or without planed joints, COLUMNS, GIRDERS, SPECIAL CASTINGS, &c., required by Gas, Water, Railway, Telegraph, Chemical, Colliery, and other Companies.

Note.—Makers of HORSLEY'S PATENT SYPHONS. These are cast in one piece, without Chaplets; doing away with bolts, nuts and covers, and rendering leakage impossible.

*Price 6s., Bound in Cloth.*

**THE CHEMISTRY OF ILLUMINATING GAS.**

By NORTON H. HUMPHRYS, Assoc. M.Inst.C.E., F.C.S.

This work contains chapters on: The Relative Cost of Light from Gas, Oil, and Candles; Products of Combustion; The Sulphur Question; The Composition of Illuminating Gas; Water Gas; Various Gas-Making Processes; Oil Gas; Properties of Fluid Hydrocarbons; Tar for Gas-Making; Destructive Distillation. Condensation; and Purification.

London: WALTER KING, 11, Bolt Court, Fleet St., E.C.

**BOWENS' Ltd. Successors,**

**STOURBRIDGE.**

MANUFACTURERS OF

**BEST FIRE-BRICKS; INCLINED, HORIZONTAL, and SECTIONAL RETORTS; LUMPS, TILES, &c., of every description.**

**Established 1860.**

**STOURBRIDGE**

**RETORTS AND FIRE-BRICKS.**

**BEST QUALITY.**

**KING BROTHERS, STOURBRIDGE.**

[See Illustrated Advertisement, Oct. 6, p. 663.]

**OXIDE OF IRON.**

NATURAL BOG ORE FROM OWN MINES.

*Samples and Prices on application.*

**WM. H. MÜLLER & CO.,**

**81, PALMERSTON BUILDINGS, LONDON, E.C.**

TRADE MARK: "Compascum." Telegraphic Address: "FERRUM."

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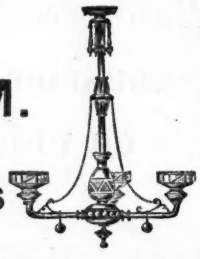
**BIRMINGHAM.**

MANUFACTURERS OF GASELIERS IN GLASS AND METAL.



**WILSON CARTER & PEARSON,**

**GAS COAL AND CANNEL FACTORS,**

**Supply to any Railway Station, or for Export, all kinds of Fuel for Gas purposes.**

ADDRESS CHIEF OFFICES:

**Temple Buildings, 50, New Street, Birmingham.**

**Wrought-Iron**

**And Fittings and Accessories.**

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MANUFACTURERS OF

WROUGHT-IRON TUBES & FITTINGS for GAS, WATER, & STEAM, BRASS GAS-FITTINGS, GAS-VALVES, STEAM & WATER VALVES, TOOLS, &c., AND OF WARNER'S PATENT MARKET GAS STAND-PIPE.

LONDON: LAMBETH BRASS & IRON CO., Ltd., Short St., LAMBETH.

**JAMES MILNE & SON, LTD.,**

**GAS ENGINEERS,**

MILTON HOUSE WORKS, EDINBURGH.

LONDON. — GLASGOW. — LEEDS.

ALEX. C. HUMPHREYS, M.Inst.C.E. A. G. GLASGOW, M.E.

# MESSRS. HUMPHREYS & GLASGOW

**Have constructed their EUROPEAN type of**

## CARBURETTED WATER-GAS PLANT

**At the following Gas-Works:—**

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|---|---|---|---|
| Copenhagen | 700,000 Cub. Ft. | Brighton | 1,500,000 Cub. Ft. |
| Belfast | 1,700,000 ,, | Preston | 1,500,000 ,, |
| Glasgow | 300,000 ,, | Southport | 750,000 ,, |
| Brussels | 700,000 ,, | Bath | 1,000,000 ,, |
| Liverpool | 3,500,000 ,, | New York | 1,200,000 ,, |
| Tottenham | 750,000 ,, | Newburgh, N.Y. | 350,000 ,, |
| Santiago | 400,000 ,, | Tottenham (Second Contract) | 750,000 ,, |
| Swansea | 750,000 ,, | St. Joseph, Mo. | 750,000 ,, |
| | | Brussels (Second Contract) | 700,000 ,, |

**And have now under Contract:—**

| | | | |
|---|---|---|---|
| Belfast (Second Contract) | 4,500,000 Cub. Ft. | Stockport | 500,000 Cub. Ft. |
| Shanghai | 225,000 ,, | Norwich | 1,000,000 ,, |
| Winchester | 200,000 ,, | Guildford | 350,000 ,, |
| Hoylake | 125,000 ,, | Syracuse, N.Y. | 850,000 ,, |
| Manchester | 3,000,000 ,, | Bordentown, N.J. | 125,000 ,, |
| Holyoke, Mass. | 600,000 ,, | Lea Bridge | 350,000 ,, |
| Edinburgh | 2,000,000 ,, | Newburgh, N.Y. (Second Contract) | 250,000 ,, |
| Stockton-on-Tees | 500,000 ,, | Coventry | 600,000 ,, |

**In addition to which the previous Installations of The Gaslight and Coke Company under this System have a total capacity of 10,000,000 cubic feet per diem.**

*9, Victoria Street, London, S.W.*

Telegrams: "EPISTOLARY, LONDON."

*United States Office, 64, Broadway, New York.*

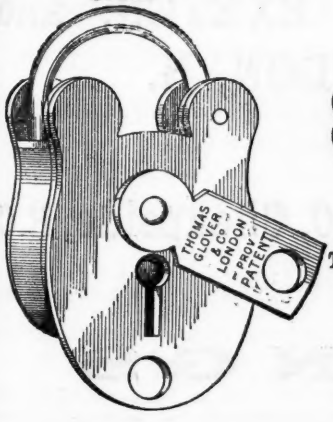
[ESTABLISHED 1844.] **ORIGINAL MAKERS.** [ESTABLISHED 1844.]

LONDON, 1851. NEW YORK, 1853. PARIS, 1855. LONDON, 1862. DUBLIN, 1865. PARIS, 1867.

THE SIX MEDALS AWARDED TO THOMAS GLOVER'S PATENT DRY GAS-METERS;

*The latter being the Highest Award for Dry Gas-Meters at the Paris Exhibition, 1867. Since then we have not Exhibited FOR PRIZES.*

OPEN.




THOMAS GLOVER & CO.'S

**PATENT**

# SECURE PADLOCK

Prevents Tampering with the

**CASH-BOXES OF PREPAYMENT METERS.**

**The Padlock is Sealed by means of a Lead Eyelet, which is impressed with Company's private mark. Eyelets easily fixed and removed by Company's Collector.**

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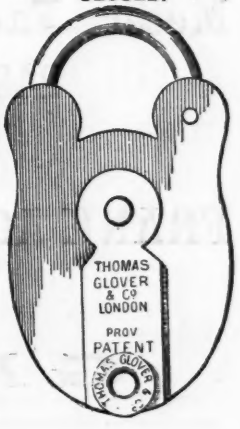


**Telegraphic Address: "GOTHIC LONDON." Telephone No. 6725.**

# THOMAS GLOVER & CO., LTD.,

**DRY GAS-METER MANUFACTURERS,**

**214 to 222, ST. JOHN ST., CLERKENWELL GREEN, LONDON, E.C.**

| BRISTOL: | BIRMINGHAM: | MANCHESTER: |
|---|---|---|
| 62, VICTORIA STREET. | 1, OOZELLS STREET. | 37, BLACKFRIARS STREET. |
| *Telegraphic Address: "GOTHIC."* | *Telegraphic Address: "GOTHIC."* | *Telegraphic Address: "GOTHIC."* |

# WILLEY & CO.,

## GAS ENGINEERS,

## LONDON & EXETER.

**Offices: HAVEN ROAD, EXETER.**

MANUFACTURERS OF

**GASHOLDERS, ROOFS, BRIDGES, GIRDERS,**

AND EVERY DESCRIPTION OF

**GAS APPARATUS.**

MAKERS OF THE LIVESEY WASHER.

**AGENTS FOR THE MAXIM CARBURETTOR.**

**Engineering Works: ST. THOMAS, EXETER.**

**Manufacturers of WET and DRY GAS-METERS of unsurpassed excellence.**

Patent Penny-in-the-Slot AUTOMATIC METER with the latest improvements. Fraud Proof, Perfect in Action, Accurate in Registration, Instantaneous Price Adjustment *in situ* without Change Wheels.

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MANUFACTURERS OF

**GAS-FITTINGS**

IN ENDLESS VARIETY.

**CHANDELIERS, BRACKETS, PENDANTS, MAIN COCKS, &c., &c., &c.**

SPECIAL FITTINGS FOR THE AUTOMATIC BUSINESS.

**Brass Foundries and Works: ST. THOMAS, EXETER.**

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# IMPROVEMENTS IN STREET LIGHTING.

**Highest Efficiency with Greatest Economy.**

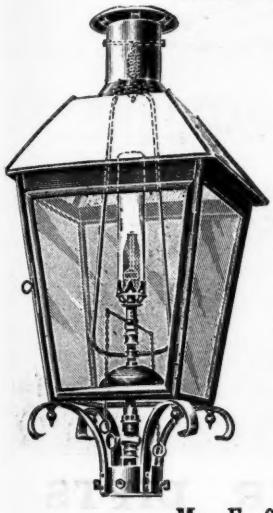
LIGHTING AUTHORITIES, GAS ENGINEERS, and GAS MANAGERS

are invited to inspect the

## INCANDESCENT GAS-LIGHT

**(Welsbach System),**

which has now been successfully adapted to the purposes of

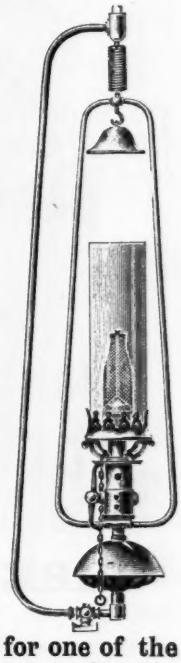


## STREET LIGHTING,

the difficulties caused by VIBRATION having been OVERCOME by the use of the

**NEW SPRING SUSPENSION FRAME (Patent).**

*This System of Lighting meets the requirements of all Lighting Authorities in those Districts where it is desired to effect an Improvement in Street Lighting WITHOUT INCREASE OF EXPENDITURE.*



The following are Extracts from a PAPER read by Mr. F. G. DEXTER, before the SOUTHERN DISTRICT ASSOCIATION.

"The success of the experimental (Welsbach) lighting secured the contract for one of the Parish Council Districts; and this was shortly followed by the contract for three years for the city lamps. The total represents altogether about 500 single lamps, and 15 refuge lamps containing two lights."

"In the matter of maintenance of the street lights, the record is favourable—in fact, more so than the estimate provided. By the test-meter, the average daily consumption works out to 38 cubic feet per light, including bye-pass. The bye-pass consumes with a flame half an inch long, $\frac{1}{5}$ foot per hour. This represents 1000 cubic feet per lamp per annum. The average consumption per light, when in use, works out to 12,900 feet per annum, or about $3\frac{3}{5}$ feet per light per hour. The lighting is continued all the year round, from the average times of one hour after sunset to one hour before sunrise."

"The mantles have worked out to an average of three per lamp per annum; but, bearing in mind the absence of frost last winter, the writer believes that four mantles per light is more likely to represent average conditions."

"In the matter of cleaning, it may be said that the lanterns require less attention than with the ordinary flat-flame burner."

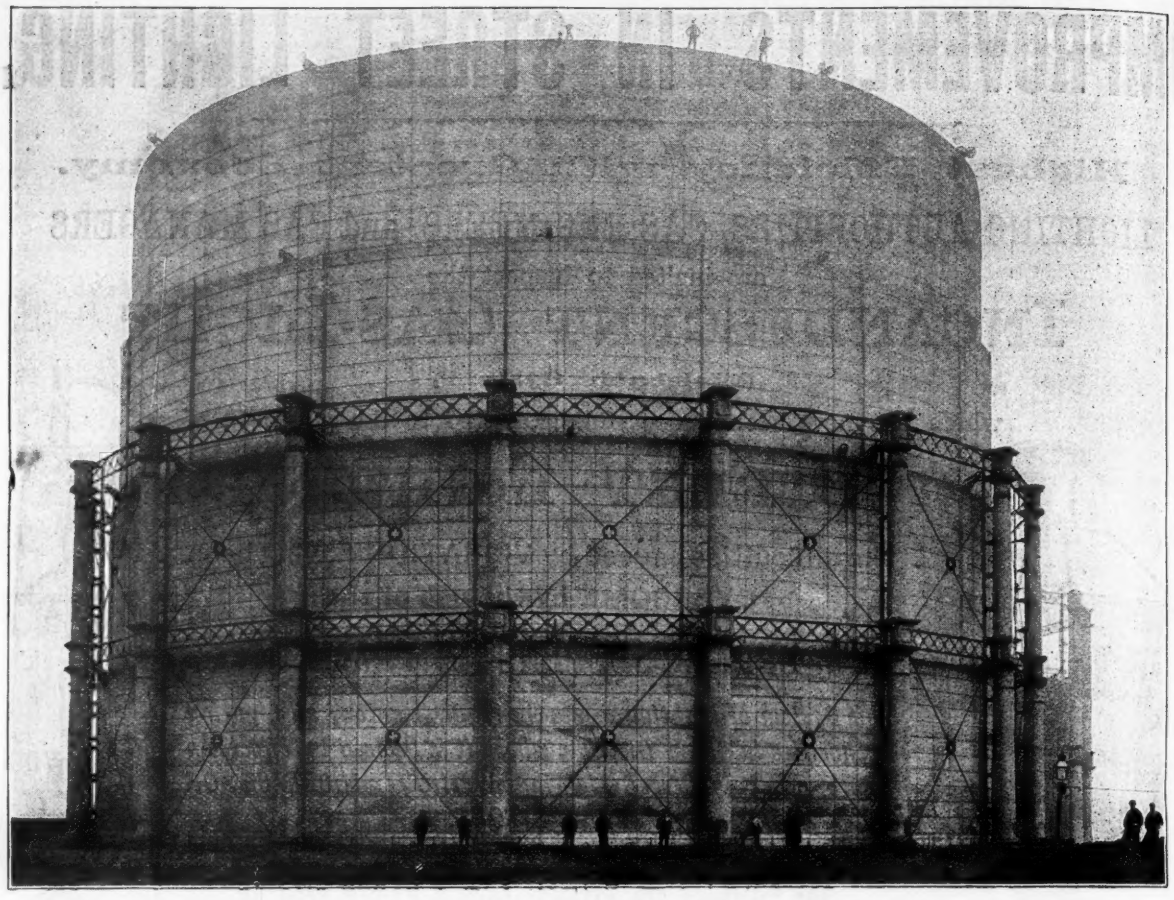
"The number of lights attended to per man averages 85."

"The 'Welsbach' Light is undoubtedly one of the greatest aids to successful competition that the Gas Industry has ever experienced. Its influence, while reducing the relative cost of light, has advanced the consumption of gas all over the country by the increased satisfaction of the existing consumers, and the attraction of others. The writer feels that its influence should not be confined to the house. It is capable of meeting every competitor in the street, from cheap oils to arc lights, in cost and in effect; and it is hoped that the foregoing experience may lead many others to seek its aid and to realize its efficiency."

FOR PRICES AND PARTICULARS, APPLY TO THE

## INCANDESCENT GAS-LIGHT CO., Ltd.,

*Palmer Street, Westminster, London.*



**BIRKENHEAD GASHOLDER, FOUR LIFTS**

(160 FEET DIAMETER, EACH 80 FEET DEEP).

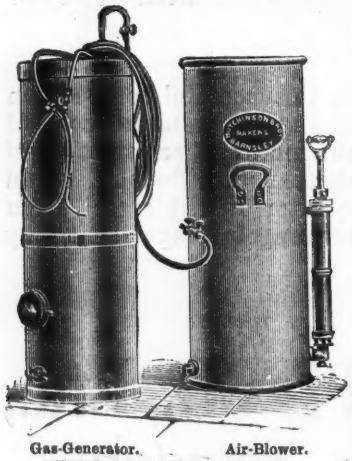
The TWO INNER LIFTS were added on the ROPE SYSTEM.
The THIRD LIFT is controlled by ROPES, as well as by Columns.

*EXTRACT FROM THE ENGINEER'S REPORT, FEBRUARY 11, 1896.*

"During a great gale on October 2nd, the holder was at its greatest height (120 feet); and I can safely say it was the steadiest holder on the works. In fact, throughout the whole of October, we experienced exceptionally heavy weather; and, of course, the holder during that time was tested in all positions, but with the same unvarying steadiness.
(Signed) T. O. PATERSON, Engineer."

THE HOLDERS in which the ROPE SYSTEM has been adopted have a capacity of 15,200,000 cubic feet.

**ASHMORE, BENSON, PEASE, & CO., LTD.,** Stockton-on-Tees.




Gas-Generator. Air-Blower.
IMPROVED LEAD-BURNING APPARATUS.

**HUTCHINSON BROS.,**
GAS ENGINEERS, &c.

SPECIALITY.
LEAD WORK FOR SULPHATE OF AMMONIA PLANTS.
BEST QUALITY OF MATERIAL AND WORKMANSHIP.
SATURATORS, all Lead, or Strong Sheet Lead, in Wood Casing,
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Liquor-Cocks, Gauge Fittings, and Safety-Valves in Cast Iron.
HYDROMETERS, TEST-JARS (GLASS OR LEAD), COPPER SCOOPS, &c., &c.
IMPROVED LEAD-BURNING APPARATUS.
*LEAD BURNERS SENT OUT TO REPAIRS.*

**FALCON WORKS, BARNSLEY.**
*Telegrams: "HUTCHINSON BROS., BARNSLEY."*

# GODDARD, MASSEY, & WARNER'S

**IMPROVED**

## Sulphate of Ammonia Apparatus.

**The most successful and approved Apparatus known up to the present time.**

FOR REFERENCES, PARTICULARS, TESTIMONIALS, AND PRICES, APPLY TO

## GODDARD, MASSEY, & WARNER,

**ENGINEERS,**

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**The Apparatus has been supplied to the following Firms—**

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NETHAM CHEMICAL CO., Limited, BRISTOL.
ANIMAL CHARCOAL CO., Limited SHADWELL.
WM. BUTLER & CO., BRISTOL.
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**And to the following Gas Companies and Corporations—**

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|---|---|---|
| ILKESTON. | BURY. | CHORLEY. |
| WIDNES. | BRIGHOUSE. | WHITEHAVEN. |
| HALIFAX. | MARKET HARBRO' | CHESTER. |
| ALTRINCHAM. | PRESCOT. | SOUTH SHIELDS. |
| DENTON. | SOWERBY BRIDGE. | LEEK. |
| ST. ALBANS. | LEICESTER. | IPSWICH. |
| DUKINFIELD. | DARWEN. | BOURNEMOUTH. |
| NORTHWICH. | NELSON. | SALFORD. |
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CHARGING OR COAL MEASURING TRUCKS.

FOUR CENTRE SIDE TIP WAGGON.

**SPECIALITIES—**

**LYON & DEIGHTON'S PATENT SCOOP FILLING WAGGONS,**

Steel Coal and Coke Barrows, Steel Charging or Coal Measuring Waggons, Railways, Points, and Crossings, Patent Turntables (requiring no Lubrication), Charging Scoops, Rake-Heads, Revolving Screens, Hoppers, &c., Cast-Iron Smith's Hearths, Steel Side Tipping Waggon, End Tip Waggons, or Universal Tip Waggons. Lyon's Patent "Cradle" Side, End, or Universal Tip Waggons for easily working heavy loads.

**C. W. LYON, Engineer, Thornhill-Lees, Dewsbury.**

## ARROL-FOULIS

**Patent Automatic Machinery**

FOR

## DRAWING AND CHARGING GAS-RETORTS.

**Full Particulars may be obtained from the Sole Makers,**

**SIR WILLIAM ARROL & CO., Limited,**

**GLASGOW.**

[See Illustrated Advertisement, Oct. 6, p. 668.]

**PELOUZE & AUDOUIN'S**

# PATENT MECHANICAL CONDENSER.

**Over 292,000,000 Cubic Feet of Gas per Day is passing through about 550 of these Machines.**

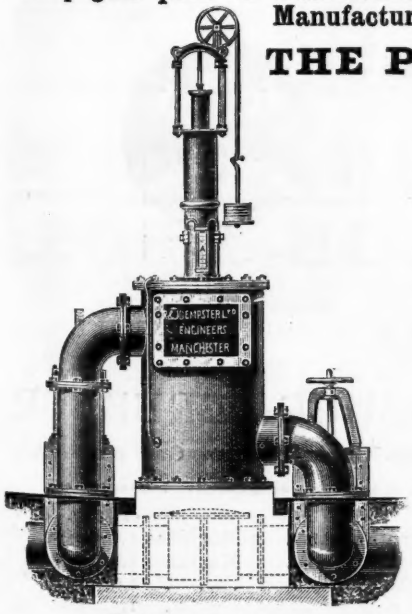
**Messrs. R. & J. DEMPSTER, Limited,**

HAVE PLEASURE IN ANNOUNCING THAT THEY HAVE MADE ARRANGEMENTS WITH THE

**Compagnie pour la Fabrication des Compteurs et Materiel d'Usines a Gaz, of Paris, to Manufacture and Sell in this Country and the Colonies,**

## THE PELOUZE & AUDOUIN CONDENSER,

According to P. AUDOUIN'S LATEST PATENTS.




FRONT ELEVATION.

This Apparatus is in very general use in most of the Gas-Works on the Continent and in America; over **550** being in use in different parts of the World for condensing and arresting all Tar Particles and Vapours from the Gases from Coal, Oil, and Wood.

The large number in use is sufficient proof of its utility. By the almost complete elimination of Tar, which is effected to the extent of 99·7 per cent., it facilitates Purification in the Purifiers, by preventing the clogging or obstruction of the Purifying Materials, which, in consequence, last much longer; thus effecting a Saving both in Materials and Labour.

So effective is this Apparatus that a piece of white paper placed over a Test-Tap on the Inlet of the Machine is immediately covered with Tar, whilst on the Outlet the white paper remains perfectly clean.

The Machines are made in the following sizes, for Works producing per 24 hours—

| | Cubic Feet. | | Cubic Feet. |
|---|---|---|---|
| 0 | 35,000 | 5 | 500,000 |
| 1 | 70,000 | 6 | 700,000 |
| 2 | 140,000 | 7 | 1,240,000 |
| 3 | 210,000 | 8 | 1,750,000 |
| 4 | 350,000 | For larger Makes, two Machines are recommended. | |

**For Prices and further Particulars, apply to the Sole Makers—**

Telegraphic Address: "SCRUBBER, MANCHESTER." **R. & J. Dempster, Ld., Gas Plant Works, Newton Heath, Manchester.** Nat. Telephone Nos. 2296 & 54.

# "HOLOPHANE" Ltd.

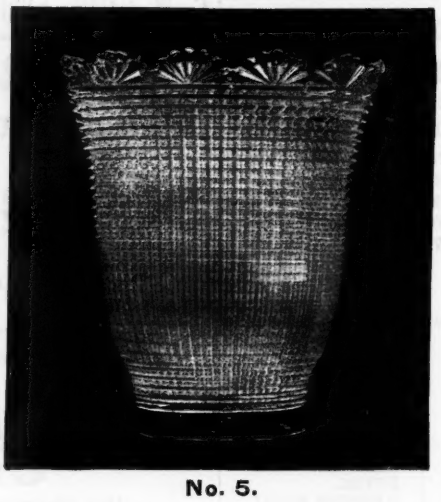
## THE "HOLOPHANE" SYSTEM FOR GENERAL ILLUMINATION

*(BLONDEL AND PSAROUDAKI'S PATENTS.)*

APPLICABLE TO ALL FORMS OF LIGHT—

ARC and INCANDESCENT ELECTRIC, INCANDESCENT GAS, and OIL LAMPS.

1. A globe designed upon strictly scientific principles.
2. Grooved vertically inside in order to diffuse the light.
3. Grooved horizontally outside in order to distribute the light.
4. Throws the light in any required direction.
5. Softens all glare while increasing effective illumination.
6. **Gives double the illumination for the same money.**



No. 5.

7. Tested and proved by the Laboratoire Central d'Électricité, Paris.
8. Results confirmed by the Edison Electric Light Company, Paris, and Professor Vivian B. Lewes, London.
9. Shows a uniformly incandescent and brilliant surface.
10. **Mellows harsh centres of light, and destroys sharp shadows.**

**Prices from 24s. per Dozen. Illustrated Lists and Terms on Application.**

SHOW-ROOM AND OFFICES: 91, 93, & 95, QUEEN VICTORIA ST., LONDON, E.C.

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Wellington, Nelson, and Market Street Works,

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RETORT-FITTINGS,
CONDENSERS,
PURIFIERS, WITH PLANED JOINTS.

GASHOLDER TANKS,
COLUMNS, GIRDERS,
LAMP-POSTS,

**And all Kinds of Gas-Making Apparatus and General Ironwork.**

**GAS and WATER VALVES and MAINS.** ILLUSTRATED CATALOGUES ON APPLICATION.

ALSO SOLE MAKERS OF

## Laycock & Claphams' Patent "ECLIPSE" WASHER-SCRUBBER,

Which is efficiently dealing with a total of **85,600,000** Cubic Feet of Gas per day.

**Repeat Orders speak for themselves, some of which are given below—**

| | | CAPACITY, CUB. FT. |
|---|---|---|
| Sheffield United Gas Company | 2 Machines | 1,500,000 each. |
| Do. do. | 2 ,, | 4,000,000 ,, |
| Halifax Corporation . . . | 2 ,, | 3,000,000 ,, |
| Keighley Corporation . . | 2 ,, | 1,000,000 ,, |

| | | CAPACITY, CUB. FT. |
|---|---|---|
| Manchester Corporation. . | 2 Machines | 4,000,000 each. |
| Do. do. . . | 1 Machine | 3,000,000 |
| Rochester, Chatham, & Strood . . . | | 1,000,000 |
| Do. do. . . . | | 1,500,000 |

CONTRACTORS TO HER MAJESTY'S GOVERNMENT.


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